PUBLIC WORKS

Devoted to the interests of the engineers and technical officials of the cities, counties and states

MAY, 1937

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Contents

TIMEWASTERS

The Fair Sex:

There was a bunch of girls on a street corner. The roving reporter surveyed them carefully and reported that all but two were blondes, all but two were redheads and all but two were brunettes. How many girls were there? *R. N. Clark.*

An Uphill Problem:

In planning for the World's Fair that will be held in Long Island (Queens, to be exact), there has been consideration given to building a giant cone which will be 200 feet high and 160 feet in diameter at the base. This will be circled by a pathway to the top, the pathway laid on a 5 per cent grade. How long will this pathway be? *Cleo F. Craig.*

A Losing Race:

A cow stood just 8 feet from the center of a railroad bridge, gazing rapturously at a Bull Durham sign nearby, when suddenly she noticed a freight locomotive approaching at the terrifying speed of 30 miles per hour. With long, gazellian-like strides she raced for the end of the bridge at the rate of 7½ miles per hour. If she had run toward the locomotive she would have managed to get off the bridge just in time, but by running away from the locomotive she was bumped just 1' 8" from the other end of the bridge. How long was the bridge? *The "Power Specialist," published by Johns-Manville Co.*

Comments and Solutions:

The eggs in last month's series sold at the following rates: A unit of 7 eggs for 1 cent; all odd eggs 3 cents each. Mrs. Goober doled out quite a few peanuts but managed to keep several for herself — 19, in fact. Lynne Bevan writes in to confess he was the author of that 9 and 11 perpetration mentioned in the March issue and gives some dope on it. We will digest this (if possible) and also the reports on same from some of our sharks, and present it in an early issue.

Texas has been heard from most emphatically on that flag-pole problem that we thought was all settled (see February issue). Capt. Gus Sauer sent a solution some time ago that we wanted to reproduce but could not because of space limitations. Now Gus writes, in part, "So I shot the flag-pole down as per my letter of March 1, and left 44.31715 ft. standing the first time, and 1.137 ft. the second time. Heck, I couldn't have missed it by five feet blindfolded and with my back turned."

There you are, gentlemen. What is the pleasure of the assemblage? W. A. H.

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A. PRESCOTT FOLWELL, Editor — **W. A. HARDENBERGH,** Asso. Editor

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PUBLIC WORKS

City, County and State Engineering and Construction

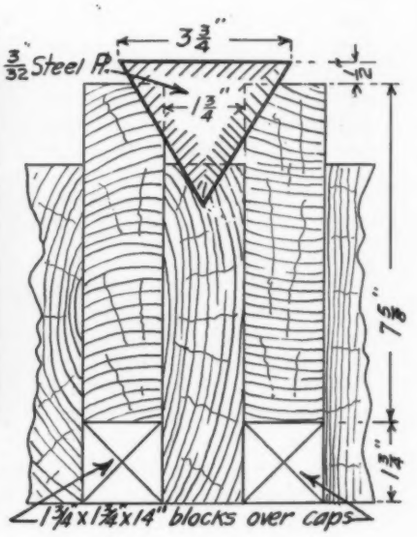
Vol. 68 — *May, 1937* — No. 5

Composite Laminated Timber-Concrete Deck on Grade Separation Structure

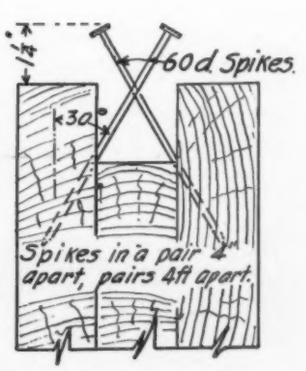
THE Alabama Highway Department recently completed an overhead crossing near Montgomery, utilizing the composite creosoted timber-concrete deck. The 500-foot structure carries the road over five railway tracks, including the main line of the Louisville and Nashville Railroad Company.

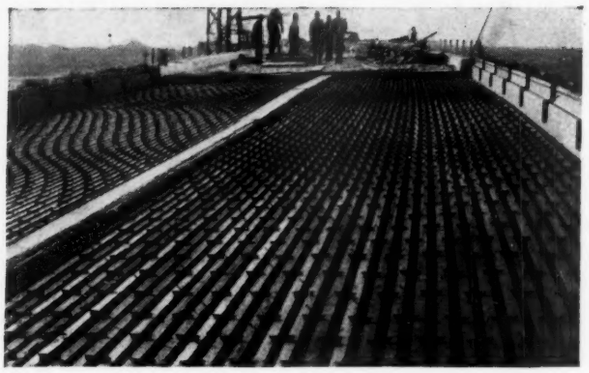
Where the main line of the Louisville and Nashville Railroad Company and three sidings are crossed at a skew angle of 47°, span lengths of 46 ft. were necessary for clearance, and this crossing was made with the reinforced concrete girder viaduct. This viaduct is approached from the east by 17 creosoted timber spans. each 19 ft. 10½ in. in length, and decked with the composite timber-concrete slab. Three spans of similar length and design form the west approach. A 190-ft. length of the east approach is on a 5° curve. The deck on this portion is superelevated, the necessary cant being framed in the pile cut-offs. Transition lengths of 150 ft. are required for the change from the superelevated to the normal crown section used on tangents. A grade raise of approximately 11 ft. is accomplished on the first 15 spans of the approach. The remainder of the grade is on a very slight vertical curve.

Bents for the substructure generally contain four



Above—The Base of the Deck Slab Is Made of Creosoted 2x8-In. Planks With Alternate Planks Raised 1¾ in. Above the Intermediate Planks. Below—The Joints of the Creosoted 2x8-In. Deck Planks Occur Over the Supports and at Quarter Points. Right Above—Section of Bridge Deck Showing Shear Developers in Place and the Small Blocks Over the Caps. Right, Below—Method of Inserting "Uplift" Spikes.





Shear Developers in Place

creosoted timber piles capped with 12 x 12-in. caps and sway braced with 4 x 8-in. plank. Caps, because of the unusual length required, are spliced near the bent centers. At every third panel point adjacent bents are longitudinally braced to form towers.

A clear roadway width of 24 ft. between curbs is maintained throughout. The timber or base portion of the deck slab is made of 2 x 8-in. planks, dressed to 1¾ x 7⅝ in., placed on edge and spiked together with 30-penny spikes. Alternate planks are raised 1¾-in. above the intermediate ones and supported by short 1¾ x 1¾-in. blocks over the cap. Small triangular steel plates 3/32 in. in thickness and about 3¾ in. on each side, known as "shear developers", are driven vertically into the longitudinal grooves to engage both the raised and lowered laminations. The tops of the shear developers extend ½ in. above the timber slab to engage the concrete top.

The function of these shear developers is to prevent any tendency to slippage between the two materials along the junction plane and thus develop horizontal shearing stresses which enable the concrete wearing surface to be utilized as an integral part of the deck slab. The concrete top, in addition to providing a satisfactory wearing surface, protects the timber from abrasion, forms the compression portion of the slab and distributes concentrated wheel loads over the wood base.

The spacing of the shear developers varies on different portions of the span, from 10 in. near the support to 23 in. at mid span, those in adjacent grooves being staggered. The number needed at any particular section depends, of course, upon the shear induced at that point.

After the shear developers were set, 60-penny uplift spikes were driven along the grooves at an angle of 30° from the vertical, and left to protrude 1½ in. above the high lamination to engage the concrete base. Two spikes of a pair are separated from 4 to 8 in., while the pairs are spaced 4 ft. center to center in each groove. These uplift spikes provide additional bond and increase the effectiveness of the shear connection. Their principal mission, however, is to prevent any uplift of the concrete surface due to curling or similar action, thus precluding any possibility of separation of the two materials.

On tangent, the finished timber slab is then capped with concrete pavement varying in thickness from 5 in. at the center to 3½ in. at the curb line, to provide the desired crown. On the superelevated section the concrete has a uniform thickness of 4½ in. Planks are all full span length spliced alternately over the supports and quarter points except for the end spans, where three lengths—20, 15, and 5 ft.—are used in the slab base.

Joints occur at approximately 80-ft. intervals, where the deck is entirely cut through, and a 1½-in. space left for expansion. Concreting was carried on in a continuous pour between these joints. The curb forms were supported on cross timbers bolted to the underside of the deck, and curbs were concreted with the roadway slab.

Joints are staggered so that only one-third of the pieces are spliced at the cap center, remaining splices occurring at alternate quarter points. Plank strips carried unbroken across the caps insure partial continuity when the concrete is reinforced for negative bending. In addition to these reinforcing bars, the deck is also reinforced for temperature stresses by half-inch longitudinal bars on 12-in. centers and transverse bars of the same size on 9-in. centers.

Small and readily obtainable sizes of lumber are used. The timber is so placed in the slab that it is lightly stressed, and low strength grades are, therefore, satisfactory. Moreover, the concrete mat which, because of its rigid shear connection, increases the effective depth of the slab, provides also an excellent wearing surface without additional expense.

All piles and timber were pressure treated with Grade One creosote in accordance with American Wood-Preservers' Association standards. Piles, bulkhead plank and bracing were treated with 16 lbs. and the remainder of the lumber with 12 lbs. of creosote per cubic foot.

This bridge was included in the Alabama program of grade separations financed by Works Progress grade separation funds. It was designed by J. P. Trotter, bridge engineer of the Alabama Highway Department, for the H-15 highway loading of the American Association of State Highway Officials. The cuts and data were furnished through the courtesy of the Service Bureau of the American Wood-Preservers' Association.

Damages Recovered for Delay Caused By Change of Plans

Claims by subcontractors on the construction of a state office building against the State of New York for damages for delay caused solely by the act of the state, whereby the subcontractors were prevented from performing their contracts within the time specified thereby, were allowed by the State Court of Claims although they had released the contractor from all claims for such damages. In the releases the contractor agreed to present the claim of each subcontractor for such damages and, if necessary, prosecute them in the court of claims.

The New York Appellate Division, Seglin Const. Co., Inc., vs. State, 293 N. Y. S. 205, modifying and affirming the judgment of the court of claims against the state as to some of the claimants and in favor of the state as to others said: "This is not the case of a contractor encountering unexpected difficulties and obstacles in carrying out his contract according to its plans and specifications; here the contractor was not permitted to perform his original contract and the delay and damage resulted from the action of the state in ordering suspension of the work while totally different plans were prepared by officials of the state, which after delay the contractor was ordered to follow."

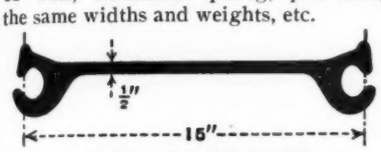
The contractor was allowed reimbursement of $6,000 paid by it to an adjoining owner for damages resulting from undermining its foundations, which would not have occurred had there been no change in the plans; the change required greater excavation and the removal of a supporting bank of earth.

Trenching for Sewer Construction

Concluding part of a chapter from the 1937 "Manual of Sewage Disposal Equipment and Sewer Construction," the first part of which appeared in the March issue.

Sheet Piling

THIS is generally of 2" plank; but for extra deep trenches or where unusual earth pressures are to be resisted or for tightness against semi-fluid soils, interlocking steel piling is often used, such as the Jones & Laughlin S W sections, which are 15" and 16" wide and weigh 23 to 35 lb. per sq. ft. of wall, Bethlehem piling, practically the same widths and weights, etc.



Bethlehem Steel Sheet Piling

Pile driving by pneumatic or gasoline hammers is more rapid than by hand mauls, less likely to jar and rupture the adjacent soil, does less damage to the top of the pile so it can be re-used more times, and in the end is cheaper in many cases. Pile driving saddles fitted into a pavement breaker operating head are suitable for ordinary driving; but for steel pile or other heavy work a heavy steam or compressed air pile driver, which is raised and held in position on the pile by means of a crane or similar piece of equipment, is desirable. These are furnished Ingersoll-Rand, McKiernan-Terry, Vulcan Iron Works, Union Iron Works; giving 90 to 55,000 ft. lb. of energy per blow. Hand mauls weighing 20 to 25 lb. and driving caps are obtainable from dealers in contractors' equipment.

Trench braces are sometimes made from 2 x 6 to 4 x 8 timber cut to desired lengths, and driven into place with sledges; which driving causes undesirable jarring of the bank. Trench braces adjustable in length by turning a lever nut are furnished by all dealers in contractors' equipment. They consist of a screw bar telescoping into a brace pipe, a lever nut on the bar forcing them apart; a socket butt on each end containing lugs which hold it in place on the sheathing. The "Anchor" brace comes from 16"-22" (least and greatest length) to 48"-58". The "Simplex" and "Duff" from 16"-22" to 60"-70". They can be obtained without the pipe, which can be furnished by the user. For close quarters, a 3-way nut without levers can be substituted for the lever nut. For wide and deep trenches, braces can be obtained to be fastened to one end of a timber brace for adjusting the length and exerting end pressure; made for braces from 4 x 4 to 8 x 8, with screws 10" to 18" long.

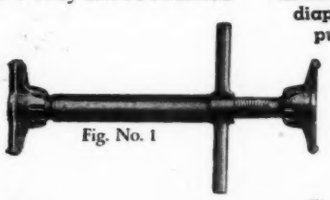


Fig. No. 1

3 Way Nut

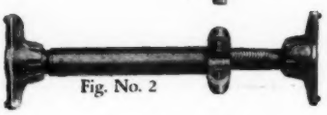


Fig. No. 2

The sheeting can be pulled by a hand lever if light and not held too tightly by the ground pressure, or by means of a jack, using a steel plank puller (made for either 2" or 3" plank); but where more force is needed, a mainfall from a derrick, excavator, back-filler, etc., or pulley on a gin pole, may be used, and for steel piling, a steam pile extractor is used—some makes of drivers can be used as extractors also.

Dewatering Trenches

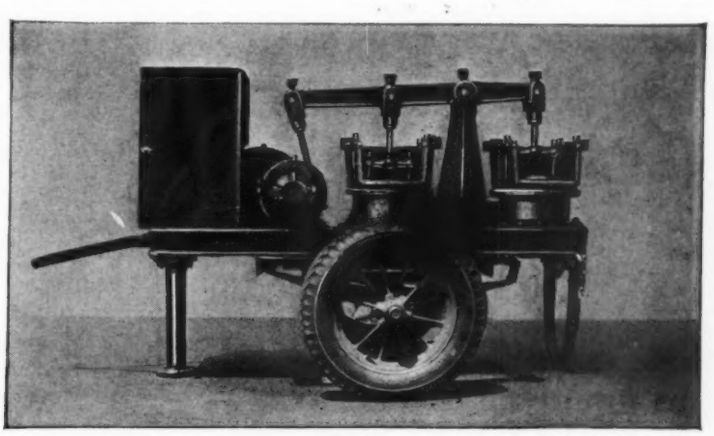
Where there is water in the ground, this makes excavation more difficult, caving in of the trench more probable, and interferes with proper laying of the sewer. In fact, if quicksand is present it may be almost impossible to build the sewer unless the water is withdrawn. The water can be pumped either from the trench, or from the ground outside the trench so that the trench itself is dry during excavation and sewer construction. In the former case the water is generally muddy and gritty; in the latter it is not likely to be so.

For pumping from the trench, diaphragm and centrifugal pumps are those most commonly used, operated by gasoline or electric motor. Pump and motor are generally built as a unit or rigidly mounted on a common base, since they must be moved frequently along the trench, and sometimes lowered into it, especially if the trench is over 20 ft. deep. The suction should be provided at the bottom with a screen readily accessible for removing chips, mud, etc., that may clog it; and should generally be in the form of a rubber hose so it can be moved about in the trench bottom without moving the pump. Rigidity, reliability and durability are of more importance in the pump than efficiency. In many cases the water need not be lifted above the pump but can be spilled onto the street, and a non-force diaphragm pump can be used. Where the water must be raised above the pump or forced through a pipe, a force pump, either diaphragm or centrifugal is used.

Diaphragm pumps for this purpose are made by Marlo (ball valves, lift 23 ft., force 20 to 40 ft., capacity 3,000 to 16,000 gph); Domestic Engine & Pump Co. (poppet valve, 2,000 to 4,000 gph); C. H. & E. Mfg. Co. (4,000 gph at 20 ft. lift); Novo Engine Co. (4,000 to 12,000 gph); Edson Corp. (4,000 to 12,000 gph), etc. These are driven by gasoline engine, or by electric motor if desired. Edson also makes hand-operated of 1,400 gph capacity. Various mountings (2-wheel and 4-wheel trailers most common) are offered by all.

There are many manufacturers of centrifugal pumps adapted to trench pumping. These should be self-priming and non-clogging. One of the smallest is the 2" "Homelite," gasoline engine and pump weighing 86 lb., handling 8,000 gph with 28 ft. lift and free discharge; a larger Homelite pumps 35,000 gph; Domestic 2" pumps handle 10,000 gph against 10 ft. head, up to 8" handling 120,000 gph. C. H. & E. pumps handle 8,500 gph (2" suction) to 130,000 (8" suction) at 10 ft. head. The Jaeger 4" general utility pump, on 2-wheel hand truck, is 44" x 29" by 35" high and weighs 770 lb. Jaeger also makes a 2" to 4" portable electric pump 13 to 20 hp. Marlow, comparing diaphragm and centrifugal for trench work, credits the former with ability to pump either small or large quantities of water, thick mud without damage to pump, but is heavier to move around, smaller capacity for same investment. Centrifugal has higher suc-

Below — Duff extension trench braces. At right— Edson double diaphragm pump.



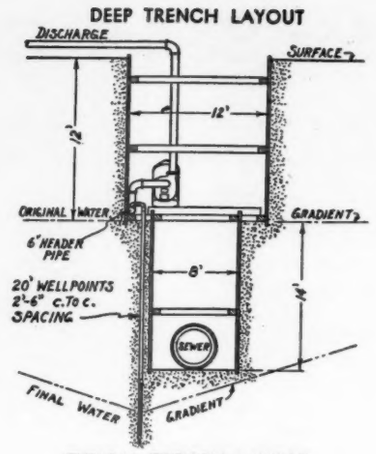
tion and discharge heads, fewer parts, but requires clearer water, more trouble with priming, wears out more quickly.

Other pumps used for trench dewatering are plunger pumps (Domestic, Marlow, C. H. & E. and others); and Thor pneumatic (2½" weighs 50 lb., lifts 243 gpm against 10 ft. with 90 lb. air pressure, horizontal dimensions 8½" x 12½" outside).

Removing the water from the ground around the trench is generally effected by means of well points driven along one or both sides of the trench before excavation of it reaches ground-water level, and pumping ground water out through them. They are generally driven two to five feet outside the trench, but sometimes inside the sheathing. They are driven to a depth somewhat below that to which the trench is to be dug; if this is more than 25 ft. or so, the pump is placed on a stage inside the trench, otherwise generally on the ground outside the trench. The well points are all connected up to one or several header pipes, each connected to a pump. The size and spacing of points, number and capacity of pumps, etc., must be carefully selected to meet the conditions as to amount of ground water, depth of trench, length of trench open at one time, etc.

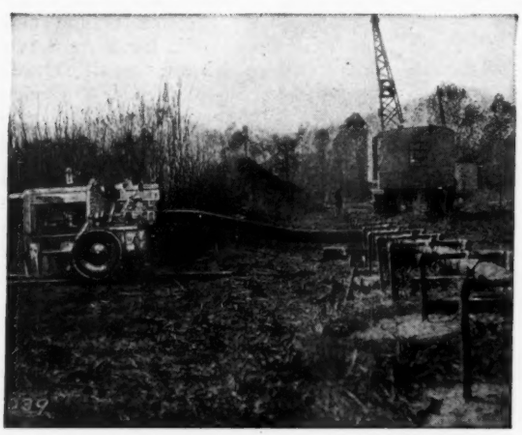
Well-point equipment designed especially for this purpose is offered by the Jaeger Machine Co., including special "sure prime" pumps, jetting pumps, well points and piping. An 8" pump is said to handle over 100 points and withdraw about 2000 gmp; a 6", 50 to 75 points, 1500 gpm. Two kinds of points are furnished—standard, for driving or jetting with separate jet pipe; self-jetting, can be driven and jetted at same time. Both have slotted screens; capacity, 90 gpm per point in coarse sand, to 25 gpm in dense soil. Two pumps connected to header pipe insure continuous operation. Layout designs are prepared on request with details as to length, width and greatest depth of trench, water supply available for jetting, disposal of discharged water, borings showing type of soil from surface to 5 ft. below subgrade, etc.

Special outfits—well points, pumps and appurtenances, etc. designed for this purpose are made by Moretrench Corp. Generally 2" well points are connected to a 6" header pipe, with a valve to each point, a 6" centrifugal pump with 20 to 27 hp gasoline or electric motor drawing from the header pipe and discharging through a 6" discharge line; a vacuum pump priming the centrifugal. The well points are jetted down with about 50 lb. water pressure, or less if necessary (hydrant pressure or a jetting pump), at intervals generally of about 3 to 6 ft. The entire equipment can be either purchased or rented.



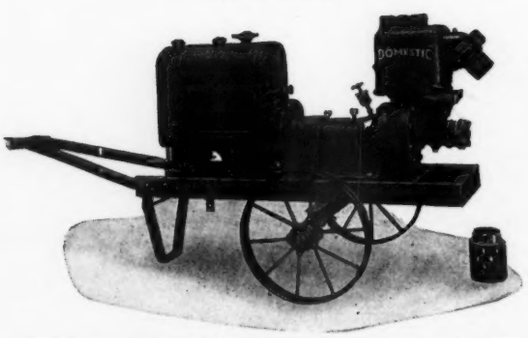
Courtesy The Jaeger Co.

Typical well point system, in deep and shallow trenches



Jaeger Machine Co.

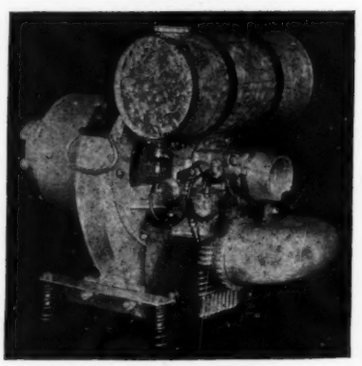
Well points and pump lowering ground water for sewer trench



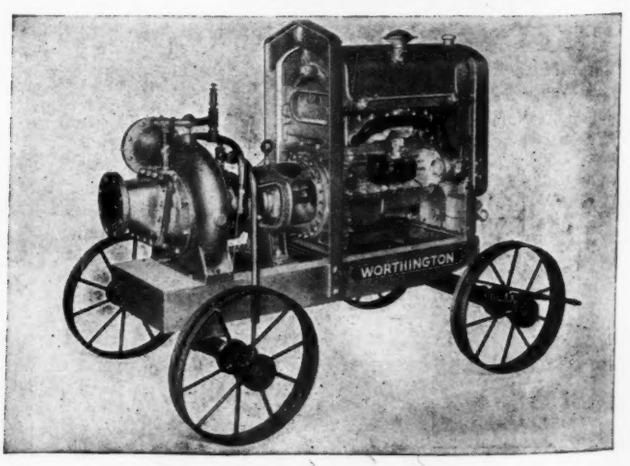
"Contractors Special" 4" centrifugal pump, 4-cylinder engine

Night Work

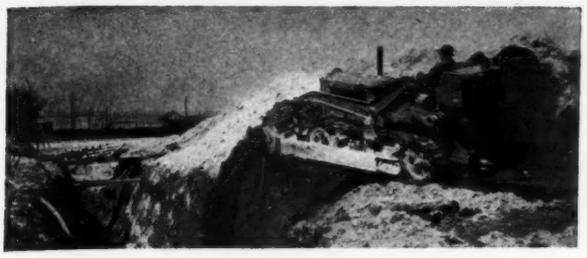
Lighting of trenches, piles of dirt and building materials and other dangers to traffic is effected by lanterns, torches, etc. Spherical torches burning kerosene, fuel oil or light distillates for 36 hours at a filling, that will not blow out, are furnished by J. G. Pollard Co. and other dealers in contractors' equipment.



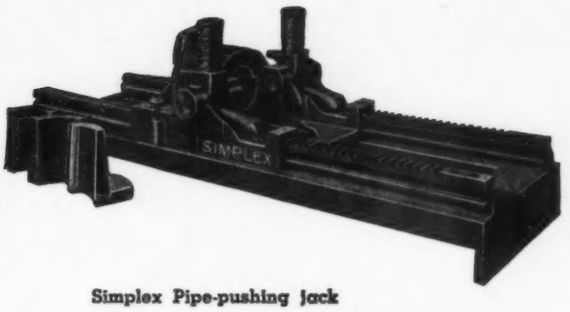
Above — Homelite 200-watt floodight; below, portable generator for lighting night work



Worthington centrifugal trench pump



A "Cletrac" bulldozing backfill into a trench



Simplex Pipe-pushing jack

Night work is sometimes necessary, and for this several types of lighting systems are available; such as the "Homelite" portable plant—a gasoline-driven generator giving 1250 watts of 110-volt current, weighing 89 lb. for direct, more for alternating current; operating six 200-watt floodlights, or a floodlight and two 500-watt spotlights; or smaller generators can be had if desired.

Backfilling

For backfilling dirt which has been piled along the trench, several kinds of backfillers are offered. They are of two general types, one of the general "bulldozer" pattern which pushes the dirt in; the other moving a blade back and pulling it toward a stationary source of power, usually on a long boom which reaches across the trench. Backfillers of the former type are made by Le Tourneau, Cleveland Tractor Co., Blaw-Knox Co., Bucyrus-Erie Co., Caterpillar Co., Baker Mfg. Co., Austin-Western, Austin Machinery Co., Koehring, and others. These are used generally for heavy backfilling only.

A backfiller of the second type with a 25 ft.-30 ft. telescopic boom swinging 160°, with 48″ x 30″ self-filling scraper, operating speed 200 ft. a minute, one-man operated, is made by the Buckeye Traction Ditcher Co. The Cleveland Trencher Co. makes a similar one which at the same time operates a tamper with 175 lb. weight dropping 26″, 45 blows a minute; the backfiller boom having a length of 14 to 20 ft. The Parsons, 15-20 ft. telescopic boom, uses scrapers 28″ high and either 48″ or 60″ long. These backfiller booms can also be used for drawing sheeting, placing pipe in trench, etc.

Power tamping is also performed by tamping tools set in the pavement breaker head or similar blow-delivering device, held in the hands of the operator.

The Jackson backfill tamper is operated electrically, using a 1 hp 3-phase induction motor.

Pipe Forcing

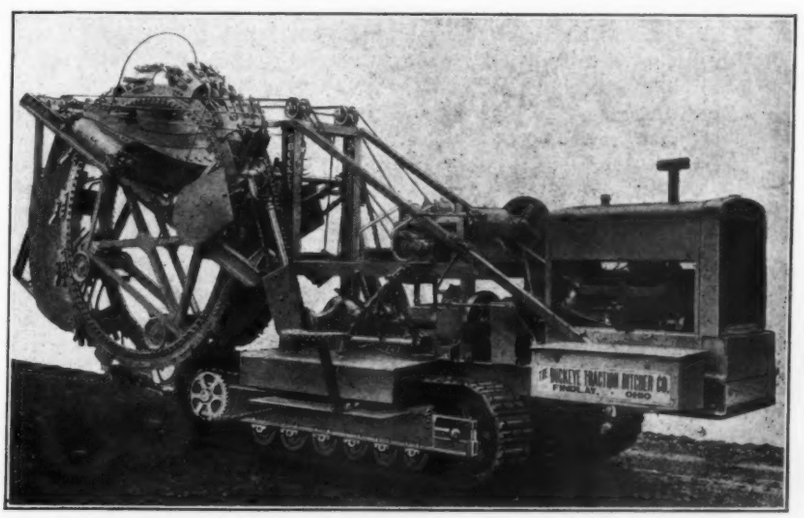
Several appliances are offered for forcing, for considerable distances through the ground, sewer pipe from 4″ diameter to four or five feet. Among these are the Duff pipe-forcing jack and the Simplex jack, the former using one lever, the latter two, to engage stationary racks; the "Giant" which exerts direct pull on the pipe jaws without a rack.

The Greenlee hydraulic pipe pusher is said to exert 40,000 lb. pressure. These are all for pipe 4″ or smaller. For larger pipe, heavy jacks are used (two 100-ton jacks for forcing a 54″ sewer in Ellwood City, Penna.—see PUBLIC WORKS for November, 1936) and the earth is removed through the pipe as it advances.

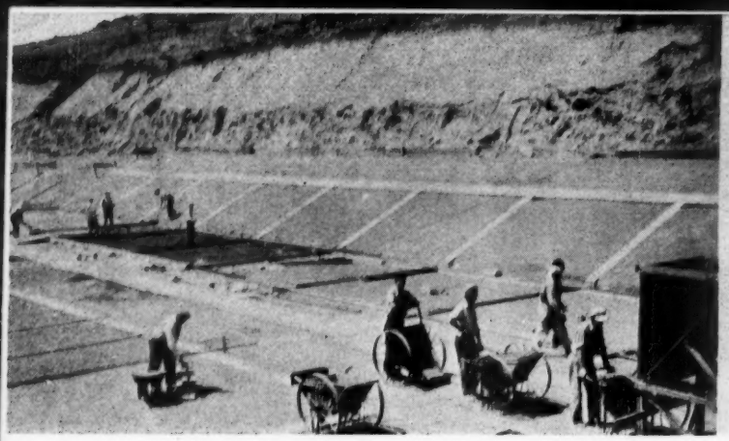
Austin trenching machine

Pavement breaker, Electric Tamper & Equipment Co.

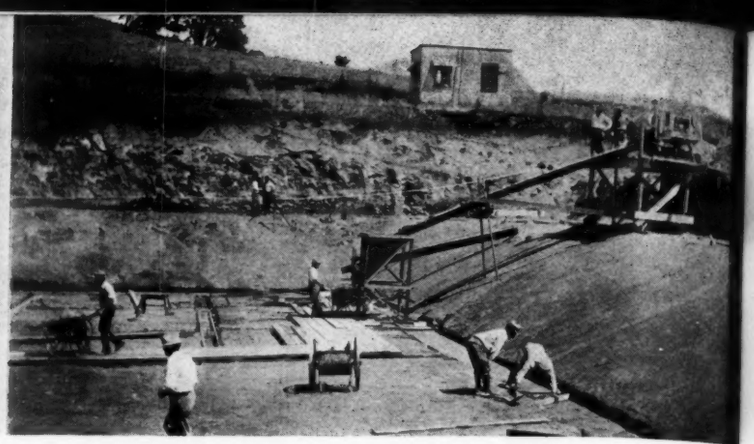
The Greenlee hydraulic pipe pusher



Wheel type of ditcher. Buckeye "General Utility"



Placing concrete in bottom. Up-hill side of reservoir



Mixer, chute and portable hopper, laying concrete bottom

Building a Reservoir and Steel Pipe Line With WPA Labor

By E. L. STRANGE

Engineer and Superintendent of Water Department, Corvallis, Ore.

TWELVE hours after the Corvallis, Oregon, water commission had arranged with the relief committee to build a proposed 6 mg reservoir as a relief project, 30 men were at work on the excavating. This was on December 15, 1933. This quick work was possible because the water department had a reservoir site, purchased about two years previous, which had been surveyed and cross-sectioned, and had prepared the plans for a reservoir to take the place of two storage pools with a combined capacity of only 750,000 gallons. However, lack of sufficient funds had prevented its construction.

The location is on a side hill with a 3 to 1 slope, and it was necessary to move approximately 10,000 sq. yd. to level up the site of the reservoir. The reservoir excavation totaled 45,000 sq. yd. The material was a sort of decomposed stone, always dry and good digging for hand work. The first work was digging ditches to intercept surface water coming down the mountain, and grading and graveling a road up the hill to the site. This and grading the site occupied several months.

This was to be a pick, shovel and wheelbarrow job, using from 30 to 100 men. As the excavation progressed and the distance the material had to be moved increased, it became evident that wheelbarrow work was too slow (although 39 wheelbarrows were in use), and four 1½ yard dump cars were added to them. These cars (designed by the author and his staff) were constructed of old automobile frames and sawmill car wheels, running on light steel rails and operated by gas engine driven hoists (borrowed for the purpose). These operated regardless of the mud.

But still the excavating moved too slowly to satisfy the government inspecting engineers, and a fleet of trucks seemed necessary when the ground became dry enough to permit using them. The county loaned us three old 3-yd. Liberty trucks, in fair condition; the Corvallis Sand and Gravel Co. loaned another 3-yd. old timer with solid tires; and we converted a ¾ ton truck which we had on hand into a dump body. As the number of men furnished us kept increasing, more trucks were needed, and by selling some unused equipment and making a few trades we had, by fall of 1934, five 1½ yd. trucks and two 3-yd. and were moving 350 yds. per 6-hour day. When wet weather returned with the winter of 1934-'35 work was discontinued for four months. May 1, 1935, a gas driven ¾ yd. shovel and trucks were employed to complete the excavation. About this time the relief set-ups changed to SERA and then to WPA.

E. L. Strange

Pouring concrete was started about June 1. No form carpenters, steel men or other skilled labor were to be found among the relief workers, and these had to be furnished at the water department's expense. Although the cost to the department was $52,000 instead of the expected $32,000, relief labor saved the department approximately $23,000. Water was turned into the reservoir in October, 1935, and the reservoir was put into service Christmas day. Backfilling around the walls and landscaping the grounds was continued through the winter with 50 WPA men.

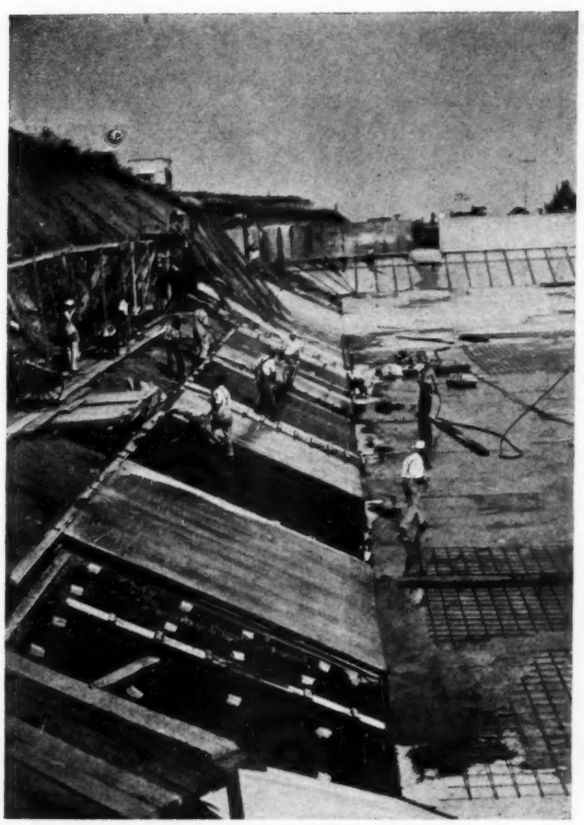
A new 14″ steel pipe line had been budgeted for construction in 1936, to replace a 12″ machine-banded wood pipe from the reservoir to the city limits, a distance of 12,000 ft. Relief labor for this project was granted with the stipulation that it be completed by July 1st. Work on this line was started April 6 and completed June 26.

Construction Details

The reservoir is 365 ft. long by 150 ft. wide, with 17 ft. depth of water. A strip 20 ft. wide around the bottom slopes up 10 ft. to a vertical wall 9 ft. high. Inside this sloping strip, the bottom slopes 12″ to two drain openings in the longitudinal center

line. The bottom and wall are built of reinforced concrete. A strip of concrete 30″ wide by 12″ deep is placed under the joint between the flat and the sloping bottom slabs. The flat bottom was made in 108 slabs, and the bottom slopes in 84 slabs; all joints tongue and groove, with a water seal of 20 oz. soft copper strips with a 2″ crimp. All joints in the water seal are bronze welded with acetylene torch (instead of the old method of soldering)—a method that was worked out with our own department crew and is now standard practice around here.

The concrete was mixed 1:1½:3 for the floor, 1:2:4 for the vertical wall, and 1:2½:5 for the footings. For the 2:1 slope a rather stiff mixture was used, run for an extra minute in the mixer. All the concrete was prepared with two settings of the mixer, and chuted to place in the bottom from staging built out at ground level. On the 2:1 slope the steel reinforcement mat and

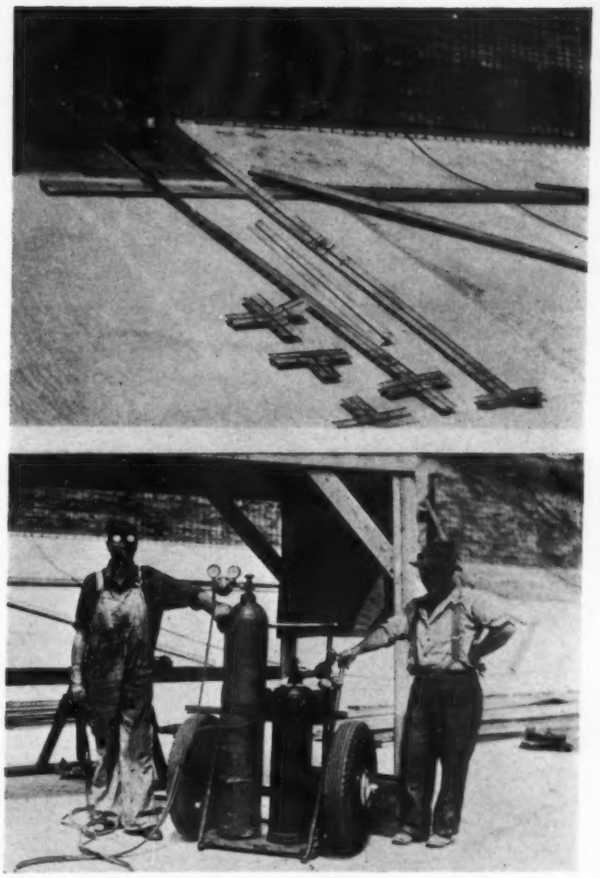


N. Side of Corvallis reservoir

the stiff mix held the concrete in place without any trouble whatever, although tamped until water came to the surface.

The copper expansion joint tees, crosses, etc., were made up in the water department shop. The assembly, placing and bronze welding were done on the reservoir floor, just ahead of the steel men. Projecting ends of tees, crosses, etc., had to be protected with movable box coverings to keep workmen from stepping on them.

Considerable care was necessary to get the workmen to work the aggregate under the projecting lip of the copper; which is very important in this kind of joint, for leakage will occur if it is not done. Eighty-six hundred pounds of soft sheet copper was used on the job, in 12″ x 9′ 6″ sheets. (Longer sheets would have saved joints, but a longer sheet metal brake was not available.)



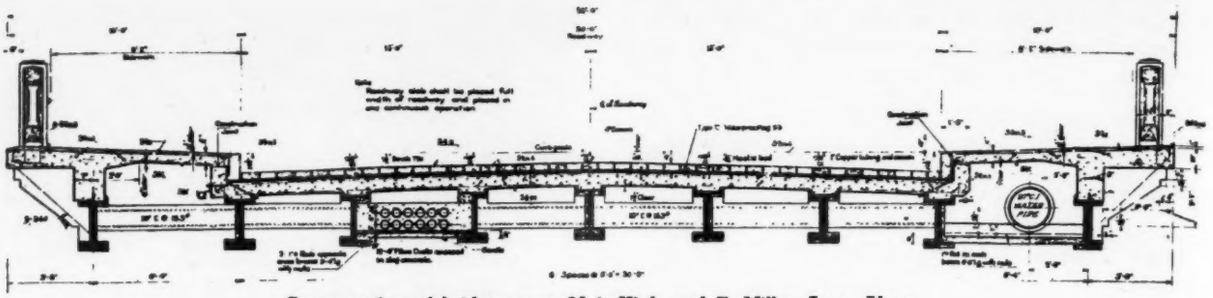
Top—Copper expansion joints for bottom

Bottom—Welding crew and equipment

Of the 12,000 feet of 14″ 8-gauge pipe laid in 1936, one-half was laid in a county road and the other half through fields. It was shipped by boat from the National Tube Company's plant through the Canal and up the Columbia and Willamette rivers to Portland, Oregon; transferred by truck to a dipping plant in Portland, reloaded onto trucks and hauled 100 miles to Corvallis, where it was assembled in piles of about 2200 ft. Two 20-ft. lengths were welded together along the trench and carried to the trench on a two-wheel dolly with pneumatic tires, one end of the pipe being

(Please turn to page 18)

Welding an elbow in place over the trench; right, Lowering 14-inch pipe into trench



Cross section of bridges over Main-High and E. Miller Ave., Akron

Akron, Ohio, Street Widening and Grade Separation Project

By E. A. KEMMLER
Mem. Am. Soc. C. E.

ACCORDING to the U. S. Census, the population of Akron, Ohio, was 69,100 in 1910, 208,400 in 1920 and 255,000 in 1930. Sometime between 1910 and 1920 the people of Akron discarded the village type of thinking and became city-minded. Up to 1913 sewage was dumped into the canal and river, untreated and unwholesome water was furnished by a private company, the sewerage system was dangerously inadequate and storm water drains were scarcely in evidence, and there were sixteen dangerous railway grade crossings in Akron and environs.

In 1910, rubber fabrication showed signs of becoming Akron's major industry, and the city soon became the rubber center of the world, producing about 85 percent of the tires used in the United States, which accounts, in a large measure for the increase of 202 percent in the population between 1910 and 1920. The increase in population created the need for more modern municipal services, and Akron embarked on a stupendous program of public improvements, for which bonds were voted from 1910 to 1936, as follows:

Water works	$19,390,000
Street paving	6,507,000
Sewers and treatment works	22,800,000
Street widening and extensions	3,780,000
Grade separation and bridges	3,400,000
Airport	1,838,000
Parks and miscellaneous	2,921,000
Total	$60,636,000

Of this total, $49,323,000 have been issued and sold.

The grade crossing elimination program for South Akron, in progress since 1919 and now in a state of revival, comprises the following units:

1. Depressing the tracks of the Pennsylvania, Erie and B. & O. railroads from East Market street to a point about 2,000 feet west of South Main street, a total of about 2⅔ miles.

2. Constructing highway bridges on Center, Exchange, Thornton, South, Miller and South Main streets, and foot bridges at McCoy, Voris, Crosier and South Main streets.

3. Widening South High street, from Hackett street to the approach for South High street viaduct at Long street (about 4,200 feet) from 40 and 60 feet to 80 and 84 feet, with 60 ft. roadways.

4. Extension of South High street, from the south end of the proposed viaduct, at Steiner avenue, to South Main street, about 1,800 feet.

The first proceeds of a bond issue of $1,000,000 for grade elimination, approved in 1916, were intended to be used in eliminating the South Main street and East Miller avenue crossings, the three railroads paying 65% and the city 35% of the cost; the total value of work possible with the use of the city's portion was therefore $2,857,000. By 1919 enough momentum had been gathered to erect a temporary viaduct on High street extension for diverting traffic during the construction of the permanent structures. This was seventeen years ago, and today the temporary viaduct is still doing duty, but the permanent structures are as yet non-existent, for meantime the world war had halted all construction work. After that, the local administration was changed, bringing with it different opinions as to the relative importance of the several crossing eliminations, and all of the money was used to finance East Exchange street, Center street and Thornton street structures and collateral track depression, which was completed in 1930.

Then came the financial depression and Akron's bonds were no longer saleable in the open market, so that in 1933 it became necessary to submit an issue of $2,400,000 for grade elimination and $3,000,000 for street widening and paving to the voters under the P.W.A. federal aid program. These issues were approved by large majorities, and under the authority granted, the city sold to the federal government $137,000 High street widening and $500,000 South Main street and East Miller avenue grade elimination bonds, and in addition, the P.W.A. made a grant of $102,000 for High street widening and the Bureau of Public Roads encumbered $750,000 federal grant for the grade elimination project. To complete the financing, the city sold $493,000 street widening bonds in the open market in 1936 and the three railroads will contribute a maximum of $300,000 for the grade elimination. The estimated cost of the entire immediate program of grade elimination and High street widened approach from the north is about $2,282,000, and that of the future south approach about $350,000; making a grand total of $2,632,000 for the entire program.

Space will not permit any discussion of the status of the High street widened approach beyond the state-

ment that it is about 4,200 feet long, roadway 60 feet wide, about one-third completed and the remainder under contract to be completed September 1st, 1937.

Grade Elimination Project

The project known as Federal Emergency Administration of Public Works Docket No. 1934 contemplates the permanent elimination of the grade crossings of the Erie, B. & O. and Pennsylvania railroads at Miller avenue and at Main street, by depressing the tracks and erecting structural steel and concrete bridges on Miller avenue and on South High street extension, and a foot-bridge on Main street. (The aerial map shows the general location of the proposed viaducts.) The High street bridge, with approaches and ramps, will replace the temporary viaduct constructed in 1919, and pave the way for a new highway lying between Main street and High street to extend southerly to a short distance beyond the rubber factories.

The new thoroughfare, when installed, will receive all the through traffic in both directions, which now passes through on High street and Main street, thereby making life safer for the 12,000 employees who enter and leave the Firestone and Goodrich factories on the two streets daily, and also permit an increase in speed of this through traffic.

South Main street, 60 feet wide, will be closed to vehicular traffic across the railroad property, and South High street, 84 feet wide (roadway 60 feet), will become the main highway, into which the Main street traffic will flow by way of a ramp designated as the north diagonal approach, beginning at Main street and Miller avenue, and another ramp designated as south diagonal approach terminating at Main street and Steiner avenue.

The project is a part of the State Highway Director's program of grade elimination under the Federal Emergency Relief Act of 1935. John Jaster, Jr. is director of highways, and J. R. Burkey, chief engineer, of bridges and railroad crossings, is in full charge of the work for the State. C. P. Schneider, who prepared the city's plans, has been chief engineer of structures and grade separation for the city since 1919. The writer was highway engineer for the city from 1918 to 1931 and service director in 1931, 1934 and 1935. W. F. Peters is at present service director. A. C. Clark is assistant chief engineer of the B. & O. railroad, W. B. Wood is acting chief engineer of the Pennsylvania Railroad, and George Fanning is chief engineer of the Erie Railroad.

Plans

The detail plans of the structures were prepared by the city's engineering forces; the railroad engineers prepared those for drainage, track depression and relocation.

The Main-High and Miller avenue bridges will be of the deck girder type having four continuous spans each, using wide-flange beams spliced over the piers, the splices being designed to take the negative bending moment. The bridges are designed for H-20-33 loading as specified by the State of Ohio, Department of Highways. Two continuous plate girders will support the Main street foot-bridge. All the bridges will have reinforced concrete deck slabs and reinforced concrete railings. All structural steel will be encased in pneumatically placed concrete ("gunite").

The approaches to the highway bridges will be earth fills with a maximum grade of six per cent. A reinforced concrete approach slab 14½ inches thick and

Airplane view of section of Akron affected by the project

20 feet long will be placed back of each abutment. The entire roadway will be paved with brick on a concrete base and with stone curbs. Steel stairs will lead to the Main street foot-bridge at each end.

The foundations for the piers, abutments and retaining walls will bear on rock. Borings at the site indicated the presence of quick-sand and other materials unfit for bearing loads or giving lateral support for piles; therefore the sub-foundation for piers will consist of steel caissons filled with concrete, and concrete pedestals will support the abutments. Caissons and pedetals will rest on rock, which is about seventeen feet below the elevation of the footings.

The project includes the lowering of six railroad tracks over a length of about 4500 feet to a maximum depth of 14 feet. This cut will require the removal of 137,000 cubic yards of earth, a large part of which must be removed from the site. The lowering of the tracks will bring the sub-grade down into the soft material, requiring an elaborate drainage system consisting of three 18″, 15″ and 12″ mains with 8″ laterals every thirty feet. The drainage system will empty into the existing 33″ storm sewer at Main street.

Maintaining Railroad Traffic

In order to maintain railroad traffic, the lowering of the tracks must be done in three steps. First, all Erie trains will operate over the westward joint main track of the Pennsylvania and B. & O. and all Pennsylvania and B. & O. trains will operate over this eastward joint main track. During this time the entire Erie right-of-way will be excavated to the new grade and new tracks laid. Second. Erie trains will operate over the new westward main track of the Erie and all Pennsylvania and B. & O. trains will operate over the new eastward main track of the Erie. The Pennsylvania switching will then be done over the present eastward joint main track of the Pennsylvania and B. & O., while the easterly half of the Pennsylvania right-of-way is being excavated to the new grade. The new Pennsylvania switching track will then be laid in this new cut. Third. The westerly half of the Pennsylvania and B. & O. rights-of-way will be excavated to the new grade and the new joint main tracks of the Pennsylvania and B. & O. will be placed in their final positions. In this way, switching service to the many side tracks on the easterly side of the Pennsylvania can be maintained.

Highway traffic can be maintained over the present temporary bridge at High street until the Miller avenue bridge can be opened with temporary approaches.

Estimate of Cost

About 71% of the construction work is designed to be done by contract. The other 29%, consisting of track and signal work, laying water mains, etc., will be done by force account. A summary of the estimate of cost is as follows:

Construction		
Roadway	$ 61,191	
Pavement	57,989	
Highway structures	219,508	
Railroad facilities	236,696	
Force account—city	23,550	
Force account—railroad	212,992	
Engineering, etc.	81,192	
		$ 893,107
Land and Damage		
Cost of land	$ 584,000	
Appraisals, court costs, etc.	16,000	
		600,000
	Grand Total	$1,493,107
Federal grant	$ 750,000	
Railroads' contribution	300,000	
		1,050,000
City's contribution (estimated)		$ 443,107

This leaves $56,893 of the city's resources available for contingencies.

Present Status of the Project

The project is sponsored by the State Highway Department which will supervise the construction. The contract plans, specifications and estimates have been approved by the Federal Bureau of Roads.

Twenty-five parcels of land occupied by buildings which will have to be removed or remodeled were secured by direct negotiation and condemnation. Only four of the cases were actually adjudicated by court action. The 13 remaining cases in which no buildings are involved will receive judicial inquiry after completion of the structures. It is expected that proposals for the construction work will be received in time to take advantage of the entire normal construction season of 1937. The work should be completed in 1938.

South High Street Extension

This extension, which will complete the South approach to the grade elimination viaduct on High street, is still in the preliminary stage. A P.W.A. application was filed at Columbus early in November 1936, and it is now being examined for transmittal to Washington. It will involve a federal loan of about $290,000 and a grant of about $60,000.

The principal features of this project are the taking of 2.7 acres of land for right-of-way, demolition of 22 residential buildings and moving the three-story post office and Y. M. C. A. building at the southern terminus and junction with South Main street.

After completion of the entire program, it is expected that High street and South Main street will become a part of the State Highway system.

EDITOR'S NOTE: Information has just been received from Mr. Kemmler that bids for the "contract" portion of the work were received on April 20, and the work awarded to Bates and Rogers of Chicago for $661,996.

Building a Reservoir and Pipe Line With WPA Labor

(Continued from page 15)

held in a bolster in the rear of the bed of a ½-ton pick-up truck with a quick-operating clamp. The 40-ft. sections were lined up on cross pieces laid across the trench and welded into continuous lengths 600 ft. long, these being joined with a Dresser coupling to serve as an expansion joint.

The pipe was lowered into the trench by means of three one-ton chain blocks, about 300 ft. of pipe at a time begin supported between the bottom of the trench and the cross pieces. Each day's welding was lowered into the trench the first thing the following morning, before the pipe expanded with the heat. In spite of this precaution the weather was so warm during the day that 20 breaks occurred due to subsequent contraction. To repair these, we hammered the weld to break it all around and rewelded it; but some of these broke again, so rewelding was discontinued and when a joint pulled apart a 1½" ring was cut out (including the weld) with an acetylene torch, permitting the gasket and follower of a Dresser coupling to be slipped over the pipe ends, a 7" center ring was cut in two crosswise, clamped in place with a temporary clamp and acetylene welded back together, and the joint made up. No further trouble has occurred with these joints.

To get arc welders out of a WPA crew seemed hopeless, but about January 1 a man was discovered who had had some welding experience and we put him in the department shop for three months' practice. He still had not learned to arc weld overhead when pipe welding was started, but just had to do it when he got on the job and got along very well, making 7 or 8 welds in 6 hours. Another welder was needed, and a man was discovered in the crew who had arc welded on a pipe line in Texas but as he could not weld overhead he was set to welding the pipe into 40-ft. lengths at the pipe pile where he could roll the pipe. Two welding machines were used on the job, which was under the supervision of an experienced welder.

Colored Asphalt Roads

Colored fillers and aggregates were first used in an effort to produce colored asphalt roads, but with only moderate success. The chemists have now succeeded in producing a colored binder by adding the pigment to a special brand of bitumen, and this, used in conjunction with fillers and aggregates of similar color, has the requisite effect, according to a writer in *Highways & Bridges*. Colored asphalt is, of course, not new, but until quite recently it had not reached the stage of practical use. Even the wearing qualities of the colored road have proved satisfactory; at least, so it would appear from results obtained with an experimental stretch in Leytonstone, England, which is a bus route, and now in its third year. A. P. Howell, Borough Engineer of Leyton, has laid some six and a half miles of this colored asphalt, on streets carrying both heavy and light traffic. In all cases its thickness is 2 in., some laid on a 6 in. concrete base, and some on water-bound macadam. The color is brick red, and pleasing to the eye. Other tints are available, but their cost is as yet against their general application. The cost of the red asphalt is about one-third more than ordinary asphalt. It has been found that the colored material has superior non-slip qualities.

The Editor's Page

Welcome to New Engineers—and Advice

Numbers of young men—and perhaps an occasional girl or two—will soon be leaving the ivy-clad halls of their respective alma maters to join up with the great army of civil engineers. We are not among those who offer condolences, but rather we extend congratulations, for engineering is lots of fun and, for the most part, offers a respectable and substantial living.

To the advice that has come and will come in profusion, we will add our bit. During the next three to five years, get your field and construction experience. Do not worry too much about the pay, or where the job is; but don't stay too long in one place. Get a variety of experience to supplement the theory you have acquired. That will prepare you for the future better than anything else. In the meantime, don't forget to study, for the habit of study and reading of technical books and publications, and the possession of a broad and insatiable curiosity regarding engineering are absolutely necessary.

But for the next five years, plus or minus, the class of 1937 should be chiefly concerned with getting basic experience, with contact with the laborers who do the actual work, and with the translation of plans into reality.

Tractor vs. Hand Shovel and Wheelbarrow

The question of hand labor vs. machinery is as active and acrimonious a subject of discussion in England as in this country—possibly more so. A most interesting method of proclaiming his opinions was employed recently by an English official in "turning the first sod" at a municipal airport. Carefully placing a wheelbarrow and shovel in front of a Caterpillar tractor power shovel, the Minister for Public Works mounted the driver's seat, ran the tractor over the hand tools so placed, and then turned a big "sod"—several yards of it—with the bucket, which act he considered "symbolic of the new era in public works construction."

The Minister, however, did not confine himself to this spectacularism; probably using it chiefly to attract more attention to his verbal expression of opinion, some of the sentences of which might well be quoted—they are as applicable here as there. "Some people say by adopting these methods we are putting men out of work, but I say that if we have to wait to have our aerodromes constructed on the old wheelbarrow and long-handled shovel system, then we will be waiting at the crack of doom. . . . I am waiting to meet the man who is tickled to death at having to handle a wheelbarrow." We must "transfer the laborious heavy work like this from the backs of men to these machines." The Nelson aerodrome will cost £35,000, but would cost £100,000 with wheelbarrow and shovel, which would be "placing on the shoulders of the people such a heavy burden of taxation to meet the additional cost as would be unbearable. . . . When I took over the portfolio of Public Works I found that at Blenheim, using wheelbarrows and long-handled shovels, it was costing the country 8s 7d a yard to shift the spoil. At Parnassus we have machines like this which can do the work, shifting broken rock and clay, for less than 1d a yard."

We believe that the fact that you cannot get back to normalcy by acting abnormally is beginning to sink in in this country. Instead of abandoning the manufacture of labor-saving equipment, we should use in such plants every man who can, or can be taught to, do skilled work there, leaving for the hand labor only those too old or mentally incompetent for such work. The "wheels of progress" are inevitable in their action; we cannot stop them, we must adjust ourselves to them or be overwhelmed.

Water Charges Collected Without Sending Bills

At almost every water works meeting, considerable time is devoted to a discussion of billing and collecting bills for water. The municipal water department of Moscow, Idaho, does not have to worry about such matters. A clipping sent to us from the April 30 issue of the *Star Mirror* of that city tells about it:

> Virtually every public and private utility in the country mails its customers monthly or quarterly statements, and even then has considerable trouble collecting. But Moscow's municipal water department mails no statements and the percentage of delinquent accounts is exceptionally low.
>
> Says Kelly Cline, city treasurer: "We have approximately 1300 accounts. It would cost more than $300 a year for postage alone to mail statements monthly to our customers, in addition to other costs incidental to mailing out statements.
>
> "The meters are read after the 19th of every month and customers have from the 1st to the 8th of the following month to drop in, find out how much they owe, and pay. After the 16th we shut off the water where payment hasn't been made.
>
> "The folks who fail to come in and pay without being billed are very few. Last month only 16 of our estimated 1300 customers failed to pay on time."

Short Wave Radio for Snow Plows

When you need a snow plow, you need it bad and you want it right now. There is a helpless feeling about being stuck in a snow drift, and besides it is usually a cold proposition. Therefore, we want to call attenton of all wideawake counties to an item on another page of this issue which announces that Lewis County, N. Y., plans to equip all snow plows with short wave radio.

A writer in the *Utica Press* pokes a little good-natured fun at the proposition, as shown in part below, but even he should be quick to acknowledge that the project is an excellent one. Among his imaginary uses of the radio are the following:

"Calling all plows! Calling all plows! Five prisoners have just escaped from the Lewis County Jail in a car. Do not plow any roads in the vicinity of the jail."

* * *

"Plow 44. Hurry-up call. The road leading to the tax collector's house in the Town of Diana is blocked. Tax receipts are dropping off. Open up road at once. Plows 55, 66, 77 assist on this call."

* * *

"Plow 88, Operator Smith, your wife wants you to stop on the way home and pick up a loaf of bread and four lamb chops."

A Sewage Gas Incinerator Burns Scum and Screenings

Sludge Digester Gas Used for This Purpose by Rapid City, S. D.

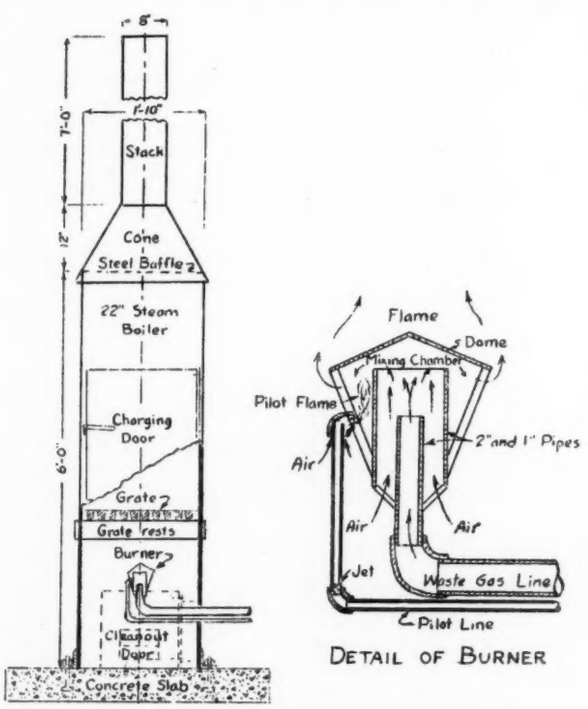
THE operator of the sewage treatment plant at Rapid City, S. D., Charles R. Price, has had in operation for some time an incinerator which utilizes gas from the digester for burning wet screenings, scum and rubbish at the Rapid City treatment plant. The incinerator has operated very satisfactorily thus far and has eliminated odors from waste gas as well as screenings and scum. It was built from an old boiler and the total cost was very low, as Mr. Price did the cutting and welding himself. His description, as sent to "The Clarifier", the monthly bulletin of the South Dakota State Board of Health, is as follows:

The body of the incinerator was made from a part of an old steam boiler about ¼" thick and 22" in diameter. The charging door is 20" x 24" and was made from a piece cut out of the boiler shell. The hinges and catch were welded to the door and the shell.

The baffle is made of ¼" steel and has an 8" round hole cut in the center. The baffle serves to protect the sheet iron cone and stack. The cone was made of 14 gage black iron and was welded. The stack was made of 14 gage black iron and was rolled and welded.

The grate is cast iron and was made in two sections so that the diameter was 21". The openings between bars are ¾". The grate rests are two 1" x 4" cast iron bars supported in slots cut in the shell.

At the bottom and on the opposite side from the charging door is a 14" x 14" clean out door. The door has a draft hole cut in it which is provided with a sliding cover. The entire incinerator is anchored to a concrete slab four feet square and six inches thick.



General Layout of Incinerator for Scum and Screenings

A detail of the burner is also shown. The size of the burner may be increased so that it would handle almost any amount of gas. This size has handled more than 15,000 cubic feet in 24 hours.

The piping to the incinerator consists of a 1½" waste gas pipe and a ⅜" pilot line from the gas main. Care should be taken to have a two-way fall to a low point inside the building or pump house. At the low point a "U" tube should be installed, having a water column *at least* twice that of the gas dome seal on the digester. The outside piping must be *well* insulated for winter.

Here are the parts of the burner:—The waste gas pipe is reduced by means of a 1½" to 1" reducing "L" or an "L" and bushing. The one inch pipe is 4" long. A 2" pipe, 3" long, is held in place around the waste gas pipe by means of four ½" cast iron welding rods welded as spokes between the pipes. Air enters between the waste gas pipe and the 2" pipe.

A steel cone dome, ⅛" thick, is held in place by means of four ½" cast iron welding rods evenly spaced. These are welded to the dome and to the 2" pipe. The dome provides a mixing chamber for the gas and air and also keeps ashes from the burner and gas piping.

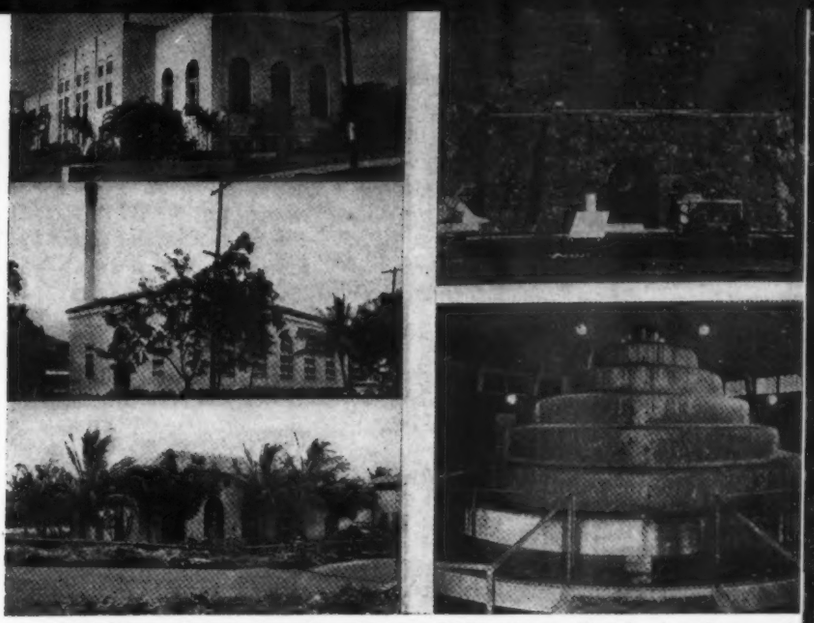
The pilot line, which is a ⅜" line from the gas main, is reduced to ¼" by means of a reducing "L" or bushing and "L". At the joint is a ⅛" jet. At the burner there is placed a ½" elbow over the pilot line which admits air for the pilot flame. This flame is kept burning all the time and keeps the waste gas burning.

Mr. Price suggests that the burner be made where it is to be used so that replacements can be made by the same person who constructed it. The conditions under which the burner must operate are such that the top parts may need to be replaced perhaps once a year. This is due to the heat that exists under the grate when it is mostly covered with wet screenings.

High Pressure Wind Tunnel Details

The new high pressure wind tunnel, which is to be constructed at Langley Field for aeronautic experimental work, is the first of its kind in the country. The cost will be about $1,000,000. The tunnel is cylindrical in shape, and arranged in rectangular fashion, with a total length of 380 feet. Diameter will vary from 19 to 54 feet. A wind velocity of 200 miles an hour will be created within the tunnel by means of a 30-ft. multi-blade propeller, driven by a specially designed motor of 8,000 hp. The effect on the model planes that will be tested will be that of a velocity of 400 miles an hour. The tunnel will be constructed of welded steel plates, ⅜ to 2 inches in thickness. The contract for construction, which will require 2,000 tons of steel and 25 miles of welding, has been awarded to the Pittsburgh-Des Moines Steel Co., by the National Advisory Committee for Aeronautics.

Water Works Construction and Treatment in Hawaii



Left—Three Hawaii pumping stations. Right, above—Portal of underground pumping station. Nuuanu aerator

HONOLULU, Territory of Hawaii, far away as it seems, has many things in common with continental United States, including help by P W A funds. It also differs in many of its conditions and methods. Some of the more interesting differences connected with its water supply are described briefly below.

The city's main source of supply is an artesian basin which is also used by private well owners. The draft on it is reaching its limit, although the rainfall in the highlands last year was 142.6 inches (11.28 in. in one day). Ten percent of the supply is obtained by springs and tunnels in valleys above the city, flowing to it by gravity. The artesian supply is obtained by 25 deep wells driven to artesian areas directly below the city, repleted from rainfall on the highlands back of the city.

The quality of the artesian water seems to be excellent. That from springs and tunnels in the Nuuanu valley is high in carbon-dioxide content, which is greatly reduced by means of an aerator placed in operation in October, 1936. Another similar one is contemplated.

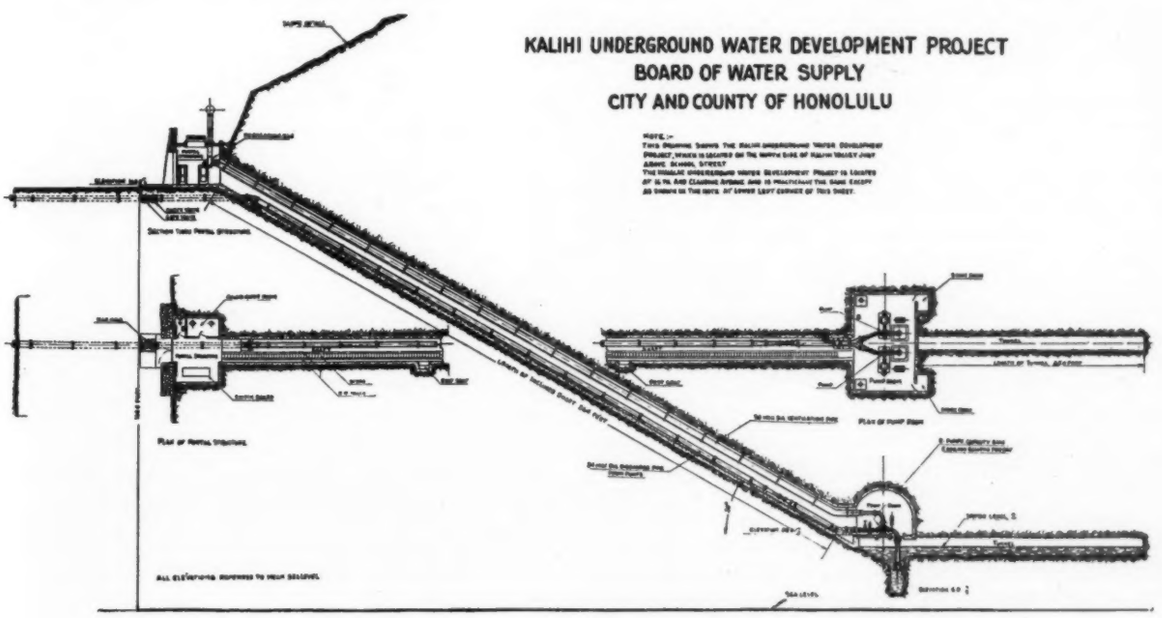
In addition to the artesian and highland groundwater supplies, there were constructed in 1936, financed jointly with P W A and Board of Water Supply funds, two projects for using underground water taken at a few feet above sea level. These were complete on February 1st except for the switchboard equipment, delivery of which was held up by the maritime strike.

There are three main pumping stations, steam operated, and seven booster electric pumping stations; also, added in 1936, two underground pumping stations and two booster stations, all electric. These pump into 25 distribution reservoirs with a combined capacity of 18,520,000 gal.

The population in 1936 was estimated to be 146,000. The consumption was 17.3 mgd artesian and 2.11 mgd mountain, supplied by the city; in addition, 13.5 mgd of artesian water was used from private wells. This gives a total consumption per capita per day of 225 gallons.

The aerator referred to was constructed over a 200,000 gallon reservoir. It consists of five circular concentric troughs, placed one above the other and increasing in diameter from top to bottom. An influent pipe rises vertically through the center, discharging into the top trough, from which it cascades over the five and falls into the reservoir. It is housed in a very artistic though plain building.

Perhaps the most interesting structures connected with



the water supply are the two recently completed projects for obtaining underground water. They are similar except for certain dimensions. An inclined shaft or tunnel at the foot of a hill slopes downward on about a 45% grade to the level of the underground water where a pump room has been excavated, and from this a horizontal development tunnel two or three feet below water level is run. Pumps in the pump room draw from a pump well and discharge through a cast iron pipe laid in the inclined tunnel to the surface. At the entrance to this tunnel is a concrete portal structure 24 x 16 x 14 ft., in which is housed all starting and control equipment; including chlorinator and ammoniator.

In the Kalihi development the inclined tunnel is 264 ft. long; the underground pump room is 36 x 22 x 17 ft., with its floor just above normal water level (28 ft. above sea level), and a pump well extending 22 ft. lower. In the pump room are two pumping units, each capable of delivering 3500 gal. per min. against a dynamic head of 190 ft. This cost about $70,000 exclusive of the pumping units which cost $15,540, and included two electric synchronous motor-driven centrifugal pumping units, with vacuum pumps and magnetic starters, exhaust ventilating fan, switchboard, and magnetic controllers arranged for complete automatic operation, centrifugal sump pumps with float control switches for automatic operation.

The manager and chief engineer of the department is Frederick Ohrt. The Board of Water Supply is somewhat unusual in that, of seven members, three are civil engineers, one is the superintendent of public work of the territory, and the other three are managers of large industries—a combination that should, it would seem, secure an unusual degree of efficiency in the administration of the water works.

Employment of Engineer by City in Water Rate Case

The city of Utica, contemplating either to negotiate with a water company a new contract for water supply in place of the one about to expire or to acquire the water system, took steps to procure data on which to determine which course was best. An ordinance was passed authorizing the employment of experts to investigate the water company's rates. An engineer submitted a schedule on which his charges for the works would be based. This was approved by the Board of Estimate, and the work was done. Subsequently the city resolved to have the regulation of the water company's rates put under the jurisdiction of the New York Public Service Commission and then to commence a rate case. This was carried out and the engineer assisted in the prosecution of the rate case. He was paid all his charges for services and expenses incurred in doing the work the parties had in mind when he was at first employed. In an action by the engineer against the city the question was whether the city was bound to pay for the engineer's service and expenses in connection with the rate case before the Public Service Commission.

The Second Circuit Court of Appeals, Potts vs. City of Utica, 86 F (2d.) 616, affirmed judgment for the plaintiff for the following reasons:

Utica is a city subject to the provisions of the New York Second Class Cities Law, § 120 of which requires bidding for contracts involving more than $500. But the court held that the city's common council's ordinance and the Board of Estimate and Apportionment's approval of plaintiff's rate of charges constituted a compliance with that part of the statute making provision for cases where it was impracticable to procure the work through bidding. Moreover, the court said, the statute itself does not cover, in respect to bidding, professional services which are technical and whose value depends upon the skill with which they are performed.

The express contract was held not to include the engineer's services and expenses in connection with the rate case; no such case having been contemplated when the contract was made. But the city was held bound to pay therefor on the theory that the common council ratified the plaintiff's employment by passing an ordinance authorizing a bond issue to provide funds for the employment of expert services for the prosecution of the rate case, the common council having authority to authorize the employment of the plaintiff as an engineer to perform personal services for the city.

Improved Water Service Lowers Insurance Rates

By HALL ARNOLD

Supt., Madisonville, Municipal Light and Water Plant

MADISONVILLE, KENTUCKY, has built improvements to its water plant which it considers very creditable for a community of 7,000 inhabitants. While the engineering features of the project are not unusual, the financial ones seem worthy of mention.

Madisonville is the county seat of Hopkins county. While the corporate limits contain 7,000 inhabitants, an additional 3,000 live in solidly built-up territory surrounding it.

In 1934, upon recommendation of the author, the city decided to build a filtration plant and a 300,000-gallon elevated tank. There was already a 100,000-gallon tank, but because of its insufficiency from a fire protection point of view, the city had a seventh class insurance rating. With the additional storage and remodeling of the fire department the city will be placed in the sixth class, which will effect a saving to the citizens in fire insurance premiums of approximately $5,000 a year.

The filtration plant was built by contract in 1935 and paid for out of the city's reserve fund. At the close of 1935 the city had a cash reserve of $112,358, with no outstanding indebtedness—one of the very few cities that can boast this, we believe. The city tax rate is 50 cents per $100 valuation, and the school tax rate $1.35.

Application was made for a PWA grant for erecting the elevated tank, but was held up temporarily pending an additional allotment of funds, and the city decided to let the contract for this without waiting and apply for assistance in constructing the concrete foundation piers and valve house for the tank and in laying 6,836 ft. of 10-inch cast-iron main to connect it to the existing main which served the old elevated tank.

The contract was let to the Pittsburgh-Des Moines Steel Co. for erecting the tower and tank; also for substituting a 48-inch steel riser for the 10-inch riser of the old tank and its frost case, and installing a 10-inch automatic altitude valve for this tank, and cleaning and painting both towers and tanks with two coats of aluminum paint.

The new 10-inch line was laid from the business section west to the new tank, and south from this to connect with the old tank, giving a duplicate 10-inch feeder line from both tanks to the business section to make ample provision for fires. This new line was connected to each of the streets it crossed.

Improvements to Princeton Sewage Treatment Plant

By I. RUSSELL RIKER, C. E.
Sanitary Engineer of Boro of Princeton*

RECENT improvements have been made to the sewage treatment plant for the Borough of Princeton using W.P.A. labor. These improvements consist of:

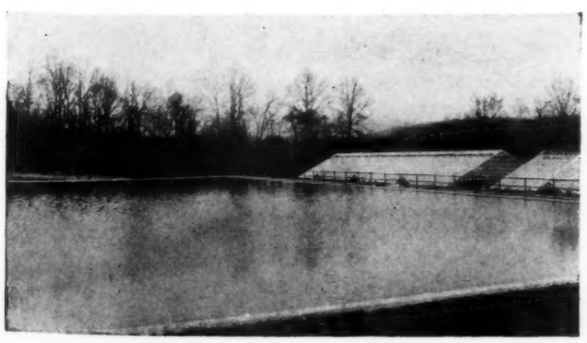
1. Chlorinating house and tower for tin cans to be used in the manufacture of iron chloride.
2. Conditioning tank for the treatment of supernatant water.
3. Division walls in the dosing tank for the sprinkling filters.

Aside from the three improvements mentioned, minor improvements were made at the entrance of each glass covered sludge bed, and a separate brick house for tools and portable apparatus, and a new garage and store house were built. Additional landscaping includes improvements to the roads and paths.

The Princeton sewage treatment plant, serving Princeton Borough, Princeton Township and Princeton University, was constructed in 1931 and '32 and placed in operation October 1932. The plant was designed for two million gallons per 24 hours. The average flow has not varied to any extent since the plant was placed in operation, being about 1¼ mgd, despite the fact that over four miles of sewers have been constructed. A number of infiltration studies were made and considerable ground water eliminated by means of repairing leaks in manholes and eliminating long leaky trunk lines by means of bypasses. The maximum sewage flow during wet seasons is still excessive, the rate at times being in an excess of 4 mgd. This is due principally to the fact that the original sewer system was laid with cement joints and that many cellars have drains connected to the sanitary sewers. (While our ordinance now prohibits this, it is not retroactive.)

It may seem peculiar, but the effluent at such times is as good as, if not better than, when the plant is operating at or under capacity. Samples of the effluent taken by the New Jersey State Department of Health in 1934 when the plant was operating at 800,000 gpd, gave the following results:

* Formerly Senior Sanitary Engineer for New Jersey State Dept. of Health.



Princeton sprinkling filter flooded for fly control

Sprinkling filter in winter

Effluent		*Raw Sewage*	
Suspended solids	60 ppm	Suspended solids	176 ppm
Nitrates	4.7 ppm	Total solids	554 ppm
Oxygen consumed	20.8 ppm	Oxygen consumed	60.8 ppm
Dissolved oxygen	6.25 ppm	Dissolved oxygen	0
B. O. D.	18.3 ppm	B. O. D.	259 ppm
Relative stability	90%		

B. Coli present in one of the hourly catch samples of the effluent

In January, 1937, when the sewage flow was 2.2 mgd, the following results were obtained:

Effluent		*Raw Sewage*	
Suspended solids	9.1 ppm	Suspended solids	95 ppm
Nitrates	8.7 ppm	Total solids	387 ppm
Oxygen consumed	5.5 ppm	Oxygen consumed	40.4 ppm
Dissolved oxygen	9.04 ppm	Dissolved oxygen	3.5 ppm
B. O. D.	12.0	B. O. D.	89.6 ppm
Relative stability	90%		

B. coli absent in all samples of the effluent.

These results clearly indicate that sewage plants should be designed not only for the number of gallons of sewage per day but according to the strength of the sewage or the population served. In 1934 the test was made in the summer when the students were away and the population was estimated to be about eight thousand, the flow was, therefore, 110 gallons per capita, while in 1937 the flow was equivalent to 170 gallons per capita.

It will be noted that the sewage in 1937 was very weak due to the excessive amount of infiltration at this particular time.

Use of Chlorine

There has been employed at the treatment plant for over two years a temporary outfit for the treatment of the raw sewage by means of ferric and ferrous chloride, made by passing a chlorine solution supplied by a portable chlorinator through a tank filled with tin cans. It was found that by the use of this method a better effluent was obtained from the settling tank; also the odors about the plant were greatly reduced and what odors did occur were found to be less offensive. It was also found that the treatment improved the digestion of the sludge, and that very often when the treatment was stopped foaming occurred in the sludge digestion tanks. We do not use the iron treatment during the winter months.

This has now been made a permanent installation by the construction of a permanent building to house the chlorinator and a permanent tower for holding the tin cans. We still apply some chlorine to the raw sewage prior to the iron treatment, but we find that the amount of chlorine applied to the raw sewage can be

materially reduced and we estimate an appreciable saving in the cost of chlorine. For instance, last year we used 17,000 pounds and the year before 18,000 pounds, against 23,500 pounds when we were not using the iron treatment. We also believe that the treatment helps the sprinkling filter, although no definite data have been compiled to support this.

Digestion Supernatant

We have had the usual difficulties with separating the sludge and water in our digestion tank, and our supernatant water has been so charged with solids that its disposal has been extremely difficult. We were unable to dispose of the supernatant water on the sludge beds because that would leave insufficient area for sludge drying. Furthermore, we believe that the supernatant water should be filtered on a special bed. The only place of disposal had been the inlet of the primary settling tank, and a great many times when we disposed of it in this manner the efficiency of the tank was impaired and the effluent deteriorated. In order to treat the supernatant water that was unfit for disposal in this way we constructed a concrete tank at a high enough elevation so that it could be returned to the sludge tanks or the dosing tank for the sprinkling filter. Supernatant water that is highly charged with solids is now pumped to this so-called conditioning tank, where it is treated with chemicals and the clear water drawn to the dosing tank and the solids to the sludge digestion tanks. Lime alone has been very successful in this treatment.

One of the improvements mentioned at the beginning of this article, which has improved the operation of the plant more than any other, is the construction of a dividing wall in each of the twin dosing tanks for the sprinkling filter. The capacity of each of the twin dosing tanks before the construction of these dividing walls was 23,000 gallons, but now it is 12,000 gallons. There had been such a large amount of sewage dosed at one time that it ran through the filter too quickly and caused a scouring action. A great deal of this material flushed on is settled in the final settling tank, but this variation in the flow caused poor settling in this tank. The flow would vary from a rate of 200,000 gpd. to 3,000,000 gpd., with a long rest period between dosings. By these division walls we have decreased the amount of sewage dosed at one time and have smoothed out the variation in the discharge from the sprinkling filter and through the final settling tank. The effect of shortening the discharge cycle on the performance of the sprinkling filter is demonstrated by comparing the results of a flush test made in 1934 by the State Department of Health with one made in 1937. In 1937 the discharge cycle was 2.5 minute discharge and 4.5 minute rest, while in 1934 the discharge time was 4.5 minutes and the rest time 30 minutes. With the short cycle the B.O.D. increased a maximum of 61 per cent and the suspended solids a maximum of 166 per cent, while with the long discharge period the B.O.D. increased a maximum of 373 per cent and the suspended solids 420 per cent.

Further studies are being made at the plant to improve filtration. A section of the filter has been covered with ¾ inch stone so as to slow down the speed of drainage in the filter. This stone causes flooding in the winter when there is no chemical treatment but works very well in the summer.

We feel that these few changes in the plant have caused a considerable improvement in the operation of the plant and have saved expense in its operation.

We are still experimenting on the control of the filter fly (Psychoda). Although we have used several sprays, including the one suggested by the N. J. experimental station, flooding has been the only successful means. By flooding the sprinkling filter every ten days to two weeks in the summer we are able to keep the fly under absolute control. We do some spraying about the sludge beds. After filling the sprinkling filter we find it must be held 24 hrs. in order to kill the lavae. During the filling period there is no effluent from the filter. During the holding period the sewage passes through the filter receiving somewhat the same treatment as in a contact filter. The B.O.D. of the filter effluent during normal operation at this time of the year ranges from 15 to 30 parts per million, during the holding period it ranges from 25 to 40 parts per million, and during the discharge period from 35 to 50 parts per million. The turbility may increase from a normal of 25 to as high as 80 parts per million. During this period the sewage is heavily chlorinated so that, while there may be a slight effect upon the river as far as B.O.D. is concerned, there is no increase in the B. Coli.

Two European Sewage Treatment Processes

In Belgium the Henry process is used for treating sludge at the only sewage purification works in use, according to "The Surveyor." One plant is used to purify the water of the Espierres river, which is practically an open sewer, receiving the sewage from a million people together with the wastes from wool-washing and other factories. The water is treated with lime and clay and the effluent turned back into the river. The sludge is transformed into small dry cakes, which are valuable as fertilizer, non-putrescible, free from odor and can be prepared at small cost.

In the Henry process the lime is ground under water into minute particles and pulverized clay is mixed with it and the sewage, the mixture then passing to sedimentation tanks with a detention period of 8 to 10 hours. The sludge, as it passes along a channel to a mixing tank, receives a dose of caustic soda and of starch grains which have been frozen and are kept so by a special machine, it having been found that the starch is far more effective if frozen. From the mixing tank the dosed sludge is raised by a centrifugal pump to a conical hopper, where sludge of 16% to 20% moisture content settles out "immediately," leaving a clear supernatant liquor.

The dense sludge then passes through the outlet at the point of the cone to a rotary drying machine around the circumference of which are cells of perforated metal lined with gauze. The interior of the dryer is under partial vacuum. The dried cake is expelled by means of compressed air. The output from a conical hopper 30 ft. diam. and 30 ft. deep is 20 tons of dry cake per day.

Another process described in the same article is one employing an enclosed trickling filter using 3″ stone for the bottom 3 ft., 3″ to 4″ stone for the top 2 or 3 ft., and between these is a layer of ¾″ to 1″ material 3 ft. or so thick. High velocity through the filter prevents clogging. Ventilation of the filter is provided by a fan at the apex of the conical roof of the enclosing structure. The capacity is said to be four times that of an open filter of the ordinary type. At the Holzwickede (Germany) plant the effluent from an Imhoff plant passes through such a filter and then through a two-story aeration tank; the amount treated is 830 cubic meters of sewage a day; the trickling filter contains 375 cu. meters of stone. The aerating room has an area of 25 cu. m., air being supplied here at the rate of 400 cu. m. a day, and the sludge falls into a settling room of 40 cu. m. capacity and is pumped back to the Imhoff tank.

Method of Using Powdered Asphalt in Italy

NEW specifications issued by the Italian State Highway Administration regarding the use of powdered asphalt (cold process) differs somewhat from the 1934 specifications. The changes are summarized in Road Abstracts as follows:

(a) the minimum asphalt content of 9 per cent. now applies to both the Sicilian and the Abruzzi products; (b) the use of oils derived from the distillation of tar or schist is permitted. The oils must have an Engler viscosity of 3 to 6 (± 0.5), measured at 25° C. if the material is for general use, and at 30° C. if the application is to be made in hot weather. The proportion of material distilling up to 200° C. shall be 2 to 5 per cent. by weight, and that of the residue left after distillation at 360° C. shall not be less than 30 per cent. by weight; (c) the use of gravel or sand as aggregate is not excluded; (d) the amounts both of mineral oil and of rock asphalt have been very considerably reduced as a result of recent experience.

Directions are given for the delivery and storage of the asphalt. Aggregates must be derived from hard, sound rock of high compressive strength; volcanic rock should preferably be porphyritic and must be fine-grained and free from vitreous material. Limestone aggregate must be of close structure and free from clay, and the broken stone should not show a laminated fracture; the normal range of sizes is 0.2 to 0.8 in., except where 0.12 to 0.2-in. material is specified. Beach or river gravel must range in size from 0.16 to 0.6 in. and sand from 0.06 to 0.12 in.

Surface Treatment

New water-bound macadam bases must be carefully prepared and thoroughly rolled and cleaned. If the base has already been surface treated, it must be cleaned with wire brooms and well washed. Regular distribution of the asphalt is secured by dividing the area into sections by means of wood or metal forms. The dry surface is sprayed with oil at the rate of 27 to 40 sq. yd. per gal. if the base is new, less oil being used on previously treated surfaces; distribution is completed by brooming, if necessary.

The aggregate should be coated with oil at the rate 2.5 to 4.2 gal. per cu. yd., or 3.3 to 4.2 gal. per cu. yd. for the surface treatment of concrete or old bituminous or tar surfacings; mixing is effected either mechanically or by hand. For first treatment broken stone 0.3 to 0.5 or 0.4 to 0.6 in. is spread at the respective rates of 100 or 75 sq. yd. per cu. yd. For subsequent treatments broken stone 0.12 to 0.3 in. is used at the rate of 130 sq. yd. per cu. yd. and 0.12 to 0.5 in. at the rate of 225 sq. yd. per cu. yd. for mechanical and hand rolling respectively; for a somewhat heavier dressing, broken stone or gravel, 0.3 to 0.4 in., is used at the rate of 100 sq. yd. per cu. yd. These rates may, if necessary, be increased by a maximum of 30 per cent.

Sand, 0.06 to 0.2 in., is used in maintenance coatings at the rate of 450 to 360 sq. yd. per cu. yd. The correct amount of asphalt is placed in each section and spread by means of floats. The total rate of application is 22 to 33 lb. per sq. yd., according to the thickness required, for the first treatment, and 11 to 15 lb. per sq. yd. for subsequent treatments, 15 lb. per sq. yd. on concrete or old bituminous or tar surfacings, and 7.5 lb. per sq. yd. for maintenance coatings. Ten per cent. of the total quantity is usually reserved for use as a sealing coat. The coated aggregate is quickly spread over the asphalt, and rolled until the surface ceases to appear dull and lighter in color than the asphalt. The final dressing of asphalt is then shoveled on to the surface and spread by means of soft brooms. Unless the gradient is steep, or the proportion of iron-tire vehicles is considerable, the road can be opened to traffic at once.

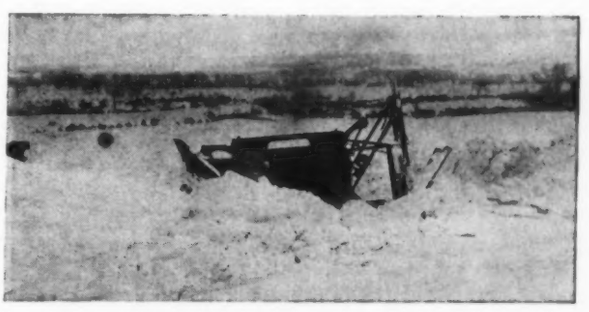
Patching Worn Surfaces

Full directions are given for patching worn surfaces. Small isolated patches may be repaired by simple applications of powdered asphalt, oil being used only in cold weather. In the repair of larger patches, powdered asphalt is placed on the cleaned and oiled surface, fine aggregate (gravel or chippings) is added, and the whole consolidated by hand rammers. In still larger patches the aggregate must be pre-coated. If the amount of patching is considerable, the whole surface must be treated, and the areas between the patches, and the edges of the area under repair, must be roughened before the treatment is applied. Large isolated holes should be cleared and oiled, and filled with a mixture of powdered asphalt and pea gravel or fine chippings in the proportions 2 : 1, the aggregate being oiled or not according to the season. Patches must be finished at a slightly higher level than that of the carriageway as consolidation occurs under traffic.

Snow Plows to Have Short Wave Radio

Lewis County, New York, is planning to install short wave radio equipment on all of their snow plows, as on some of the highways they are keeping open, the snow removal equipment is five miles from the nearest telephon. It is, accordingly, difficult to keep in touch with headquarters.

During a late winter storm, plenty of snow fell and drifted. The accompanying illustration, showing a Frink snow plow, with leveling wing, installed on a 200-hp. Diesel motored truck, indicates the depth of the snow.



Plow provided with short-wave radio equipment

A Review of Sewerage Developments in England in 1936*

ONE of the most outstanding features of sewage disposal in England in 1936 was a tendency to centralization, especially in the London area. Illustrations of this are the Mogden works serving over a million people and costing $27,500,000; the Davyhulme plant to treat 16 mgd (English gallons); the Strongford scheme at Stoke-on-Trent for 146,000 population costing $1,500,000; the new works at Leeds costing over $10,000,000; the Nottingham works for 300,000 population costing over $5,000,000. Each of these is a single plant rather than several scattered installations.

Combined Sewers Vs. Separate

It is still the very general practice in England to build combined sewers, provide at the works to treat 3 to 6 times the dry weather flow, and discharge the surplus above this into the nearest streams. "One of the most serious defects of our sewerage systems is the admission of storm water from sewer overflows into rivers," which creates a health danger. A "high authority" has suggested separate systems of sewers. (This is in marked contrast to this country, where most state health boards require collecting the sanitary sewage in a separate system of sewers, unless exception is made for special conditions.) In addition to reducing the treatment plant capacity by 66% to 83%, Lieut. Col. C. H. H. Harold says: "The provision of separate sewers for storm and rain water may be a costly matter, but on the other hand, if a policy of discharging clean surface water and rain water at any convenient point on a river were adopted, the cost of the work would certainly be reduced, and this would be accompanied by the enormous advantage of being able to make the sewers for foul sewage of a reasonable size—possibly of one-sixth the capacity, or less, of what would otherwise be required in a combined system."

Sewage Treatment

In the matter of trade wastes, "it is evident that the tendency is towards their inclusion in the public sewers, and that such preliminary treatment as may be necessary in order to make this method possible will have to be given," which resolves itself largely into the interception and utilization of by-products, simple settlement and regulation of inflow to the sewers.

In activated sludge and other oxidizing treatment there was little novelty to report. The Davyhulme air-diffusion plant has proved so satisfactory economically that existing contact beds are to be replaced with similar units. Research has produced a number of suggestions, among them possible combinations of activated sludge and filters; as at Rotherham, where the effluent was improved 30 or 40% by returning the filter effluent to the settled sewage entering the bio-aeration tanks; and at Reading, where partially activated sludge effluent was further treated on filters at a relatively high rate.

There is much discussion but little progress in the use of sewer gas for pumping. The chief example is Eastleigh; but several plants use the gas for driving air compressors, lighting and generation of heat.

Mechanical Equipment

Mechanical equipment is found in many of the recent plants. At Nottingham, the detritus is removed from the tank by means of a mechanical dredger; fine screens are cleaned mechanically; macerators turn the screenings to pulp. At Southport, sewage before discharge into the sea, is passed into the interior of a cup-type cylindrical screen 18 ft. in diameter, consisting of galvanized plates around the periphery, punched with ⅜ in. square holes; the screen rotated at a speed of 16 ft. per minute and the solids being carried up to a point near the top of the screen, whence they are removed. The increasing use of the mechanical disintegrator at sea outfalls is notable.

Various materials are used for sewers—vitrified clay, concrete, cast iron, etc. In the case of large concrete sewers it seems to be the general practice to line them with brick.

In this review of sewage treatment, considerable notice was paid to American practice; in fact, about 40% of the space. But no mention was made of American sewer construction practice and material.

*Greatly condensed from the annual review of "Municipal Engineering in 1936" of the English journal "The Surveyor and Municipal and County Engineer."

Springtime for the Sewage Plant

During the winter months most operators have not drawn sludge. In unheated digestion tanks do not be in too big a hurry to draw off sludge unless these tanks are full. During the winter the digestion has progressed very slowly. With higher temperatures, this winter's accumulation of sludge will start digesting. Unless there is sufficient seeding material left in the tank to neutralize the effects of the first stages of digestion, the winter accumulation may cause foaming when digestion starts. When it is necessary to draw off sludge, draw off small quantities at frequent intervals rather than large quantities at infrequent intervals.

The sludge bed no doubt needs some attention. Level the sand surface and be sure that all old sludge or soil is removed. If any growth of grass or weeds appears, pull the same immediately. These roots will quickly clog a sludge bed.

It has probably been impossible to break the scum in the gas vents of Imhoff tanks. This should now be done and the accumulation of floating material should be removed and burned or buried.

Trickling filters should be checked over to be sure that all underdrains are open and that all pipe lines and nozzles are in first-class condition.

Intermittent sand filters should have any accumulation of sludge removed. The sand surface should be leveled and, if necessary, new sand added.

The material around the plant, which has accumulated during the winter, should be disposed of by burial or incineration. A good thorough cleaning of all surfaces in contact with sewage is advisable. A few days of warm weather is apt to produce odors.—So. Dakota Water & Sewage Conference.

The Flint Creek Pipe Line

A Notable Example of PWA Water Conservation in Western Montana

By J. S. JAMES
State Engineer

THE pipe line to be described is an essential unit in a project to provide a supplemental water supply to Flint Creek valley, in Granite county, Montana. This valley extends for some forty miles, beginning about fifteen miles south of Philipsburg and running north to the town of Drummond, at the confluence of Flint Creek and Clarks Fork of Columbia. A gross area of about 50,000 acres will be served, most of which is under existing ditches.

The new development supplements the existing supply by adding the water of East Fork of Rock Creek (the flow of which greatly exceeds any present or prospective requirement along its valley), storing it in a reservoir of 16,000 acre-foot capacity, formed by a 90-foot earthfill dam, now under construction by the Barnard Curtis Co. The foundation work of this dam was largely completed last fall and the dam is to be finished next summer.

The outlet conduit for the reservoir is a 54-inch reinforced concrete tube, lined up stream from the control tower with ⅜-inch welded steel pipe. Dual control of the outflow will be provided by installing both an emergency gate valve and a pivot operating valve, placed in tandem on the line. To carry the conduit across the creek, the concrete tube is continued as an inverted siphon of 54-inch steel pipe 4,056 feet long, which in turn is succeeded by about two miles of canal, which passes through the divide from Rock Creek to Flint Creek valley and discharges into Trout Creek, one of the principal tributaries of Flint Creek.

From this point down Flint Creek valley, numerous existing and new ditches will serve to distribute the augmented supply over the 50,000 acres to be served.

The total footage of the steel pipe line was 4,056 feet. It was constructed of ¼″ plate Hardesty straight-seam welded pipe, hot asphalt dipped and 40-pound rag felt wrapping, the pipe being shipped onto the job in 24-foot lengths, with one end of each pipe swaged for field welding. Eleven 54″ diameter Dresser couplings were supplied for expansion joints. These couplings had a ⅜″x10″ center ring.

There were a number of other special fittings, such as an 18″ manhole and 4″ and 6″ drain valves of Rensselaer type. The purchase price, delivered to Philipsburg, Montana, for this entire lot of material was $36,276.82.

Above, near the inlet of the Flint Creek Siphon. Below, concrete saddle with anchor straps.

In addition to this siphon pipe there were 12″ and 18″ diameter 14-gage paved-invert, close-riveted culverts, several Calco metergates, four large all-steel gates, and 624 feet of 36″ diameter 3/16″ plate welded pipe, with the same coating as for the large siphon. This entire project was Montana SWCB PWA Docket 1009, Main Supply Line Flint Creek Project.

The pipe line was installed by Clifton & Applegate, who are also the contractors on all canal work. The pipe line and main supply canal, of which it is a part, was virtually completed in 1936. All canal work will be completed some time in the summer of 1937.

The project, although of striking proportions, involves no unusual engineering problems, so its design includes no innovations. Therefore, special interest attaches not to the construction features, but rather to the program under which the improvement was accomplished.

This project is part of a State program of water conservation, looking to a better use of water and land resources. This program differs basically from some earlier irrigation promotions in that it is not speculative and does not propose colonization of new raw areas and development of prospective or speculative values. Rather, it is designed primarily to save and build up existing values, particularly the human values of existing communities.

54-inch Dresser coupling **Field welding pipe**

It is appropriate that this work is being financed by loan and grant from the Public Works Administration which was called into being by a national need of reconstruction. This project and ten others now under construction or complete in Montana present ideal instances of this federal activity. Loans are secured by liens on the water, the commodity of highest value in these areas. Grants are justified not only, as in other PWA projects, by immediate employment, but to a much greater extent, by the continued employment offered by prosperous and stable communities with facilities to make a proper use of their basic resources of land and water.

This pipe line is part of a state's effort to take its part in a sound national plan of reconstruction based on conservation and proper use of our fundamental resources.

The State Water Conservation Board was set up by law to meet the basic needs of the State by planning and carrying out a comprehensive program of water conservation projects. In adapting its special problems to the necessarily general requirements of PWA, it has been confronted with problems so complex as to seem at times bewildering. However, it has established a sound plan of organization, for construction finance, and for operation. It is setting up a rational program of reconstruction through conservation and proper use of water, in line with and as part of the national plan. This pipe line and the other structures already built are material evidence of actual accomplishment. It thus stands as a monument encouraging us to carry on.

Some Sewer Practices, Wise and Otherwise

A survey of the practices of eight California cities with populations varying from 13,842 (Modesto) to 634,394 (San Francisco), in the maintenance of their sewers was made by Raymond R. Ribal, office engineer of Oakland, Calif., and the results given in a paper before the Sanitary Engineering Division of the American Society of Civil Engineers. Some of these which seemed to be of most general interest we have abstracted in the following paragraphs.

Location, construction features and spacing of manholes are the most vital factors affecting sewer maintenance costs. Regardless of block lengths, the spacing should be less than 400 ft.—the maximum distance convenient for rodding. Oakland is building additional intermediate manholes where spacing is excessive.

Noisy manhole covers are a constant source of trouble. Asphalt, lead, burlap and old tire tubes have been tried as remedies; asphalt is the most successful but makes removing cover difficult.

Catch basins are no longer built in San Jose, Sacramento and Alameda. They are not needed to collect silt, are odorous unless kept clean, breed mosquitoes, and the traps are often ineffective for trapping sewer gas and are liable to stop up and render the whole inlet ineffective.

Flush tanks are being discarded because of the cost of water, of maintenance of metal parts, and of attention, and because of greater flow of sewage itself.

Poor sewer joints have given the most maintenance trouble, permitting entrance of sand, tree roots, and ground water infiltration. "The character of the jointing material is secondary to the workmanship, and in order to ensure good workmanship a hydrostatic test and more rigid inspection will be necessary."

House connections give the most trouble from stoppages, due largely to their shallowness, accessibility to roots, and poor jointing. San Francisco constructs the house connection to the curb, marking its location with an "S" in the curb or with a stake. Berkeley constructs 4″ vents with cast iron caps just behind the curb.

Three men function most efficiently as a sewer maintenance crew—a foreman (who drives the truck) and two laborers. The more or less common equipment comprises a pump, 40 sewer rods (with 4″ and 6″ root cutters, spear and spiral), straight nozzle for flushing, hydrant spanner, hydrant gate valve, 300 ft. of 2½″ fire hose, 3 shovels, 6 picks, earth tamper, sledge hammer, cement trowel, bucket, 2 pairs of rubber boots and lanterns.

Oakland has gas masks and a safety lamp as a precaution against gas in sewers. San Francisco provides electric lanterns. "Safety lamps and gas detectors should be the first items on the equipment list of a sewer maintenance crew, and portable air blowers should be provided to ventilate sewers or manholes where gas is detected."

The annual cost of sewer maintenance in these eight cities varied from $17 to $84 per mile (the latter includes $12 for water), or from 6.5 cts. to 26.8 cts. per capita (the latter 23.3 cts. without water). In general, the cost of maintenance per mile varies directly with the population and the cost per capita inversely with the population.

Acceptance of Pavement Barring Claims for Damages

The Wisconsin Supreme Court held, City of Wauwatosa vs. Jacobus & Winding Concrete Const. Co., 271 N. W. 21, that on acceptance of a concrete pavement by a city, the city waived any claim for damages and was estopped from asserting any claim therefor against the contractor or its sureties, in the absence of any showing of fraud on the part of the contractor or the city engineer and his assistants or collusion between the contractor and the engineer or the Board of Public Works, on the ground that the concrete slabs were not as thick as they should have been had the contract been meticulously complied with. This, the court said, was at all times easily discoverable and could have been promptly remedied with little additional effort or expense.

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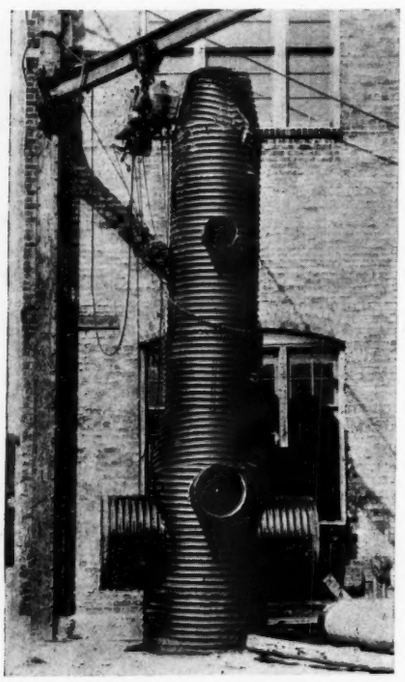
Kinks in Sanitary Engineering

A New Kind of Sewer Manhole

A storm sewer 1575 ft. long and 36″ diameter was built last year in Alexandria, Minn., which contained two or three unusual features. The pipe used was asbestos bonded Armco paved invert, which was made oval instead of round, laid with the longer axis vertical, to provide greater strength, which we believe is unusual. The soil is sandy and the depth of trench varied from 12 to 30 ft., a condition which necessitated close sheeting and ability to carry heavy backfilling without rupture. The pipe was laid in long sections, and as no bellholes were required, the trouble often experienced with these in running sand was avoided.

The storm water was admitted to the sewer from corner inlets to manholes placed at the street intersections. These manholes were another unusual feature—they were built entirely of corrugated pipe, (by the manufacturers of the storm sewer pipe), using 48″ pipe for the bottom, then a taper section followed by 36″ pipe, then a top taper to 24″. Four outlets were welded into the manhole at the proper elevations to connect with the inlets. A ladder of galvanized iron rods was provided on the inside. The illustration shows a manhole about 18 ft. high at the factory ready for shipment.



Manhole made of corrugated pipe

Carl Erickson was city engineer and designed the system. Construction was under the direction of the W P A district engineer, Scott W. Lawrance in cooperation with Mr. Erickson.

Lining a 48-Inch Steel Main in Place

Since July 10, 1889, the entire water supply of New Bedford, Mass., has been pumped from Little Quittacas pond through a 48″ steel force main 8¼ miles to a 67 mg. reservoir 164 ft. higher; from which it flows to the city by gravity through two 36″ c.i. pipes about 4.6 miles long. It also has been possible since 1922 to pump directly to the city through a 48″ and a 36″ main, using either reservoir as a balance.

Last year the old 48″ steel force main was reconditioned, as it had been found to be pitted on the inner surface. The entire 8 mile length was thoroughly cleaned by sand scraping, brushing and finally by a water and air jet under 110 lbs. pressure per sq. in. The cleaning was immediately followed by placing ⅜″ wire rods and a mesh consisting of 3x3 inch No. 10 electrically welded wire fabric. A mixture of three parts sand to one part cement was shot on under about 75 lbs. air pressure. The final finish was by screeding and hand brushing.

The result is a smooth, dense concrete lining 1¼″ thick which should preserve the pipe for many years and prevent tuberculation.

The pipe was 5/16″ thick and in many places the pitting extended more than half of its thickness. This indicates that if this work had not been done, the pipe would have lasted only a few years longer before failing in places.

The water used for filling the pipe was sterilized with chlorine gas to remove the danger of pollution by men working inside. This chlorinated water was then drawn off before pumping to the reservoir was started. This was done with the assistance and under the supervision of the engineers of the Massachusetts Department of Public Health.

In spite of the fact that the inside diameter of this pipe had been reduced 2½ inches, the friction head remains the same as it was before relining, the loss due to rivets, tubercles and joints being as much as that caused by the 2½″ reduction in diameter.

Both mains are now in use; which results in a reduction of 5 ft. in the friction head when pumping at the usual rate of ten million gallons per day, and about 28 ft. when pumping at the rate of twenty million gallons per day.

The main part of the work was done by the Tucker Construction Co. of Providence under contract. The work of uncovering and replacing manhole covers, furnishing water connections and sterilizing was done by this department under force account.

The contract price for cleaning and guniting the 42,381 ft. was $3.12 a foot, or $132,229. The work was done as a PWA project, 45% of the cost being granted by the Federal government. Stephen H. Taylor is superintendent of the water department.

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A Digest of the Sewerage Literature of the Month giving the main features of all the important articles published.

The Digestion Tank

Invert destruction of a 5-ft. concrete sewer at West Allis, Wis., due to concentrated pickling acids, was so great that for 2100 ft. the entire invert was destroyed and the soil below eroded 2 ft. deep. To repair, the cavity in the soil was filled with 1:6:12 concrete, the original sewer invert with 1:2:4 concrete in which was set half-round vitrified salt glazed sewer pipe 18″ diameter, jointed with "GK" bituminous compound. It was believed that when storm water overflows this split pipe it will so dilute the acid that it will not attack the concrete. This has given complete protection for four years.[G15]

Sewer deterioration due to sulphuretted hydrogen, in a Los Angeles sewer 10′ to 12′ diameter and lined with vitrified clay lining blocks 9″x18″ with cement mortar joints, built in 1922, has been investigated recently. Joint cement above the normal flow line is generally soft; there is a great deal of spalling of the liners due to swelling of the mortar when attacked by the sulphuric acid, and many liners have been forced off by swelling of the concrete under them. The cement is first attacked between the high and low water levels caused by daily variation in flow and the crown of the arch is attacked last. Deterioration is greatest at sharp changes in grade or line where turbulence occurs and consequent release of sulphuretted hydrogen gas is greatest.[E11]

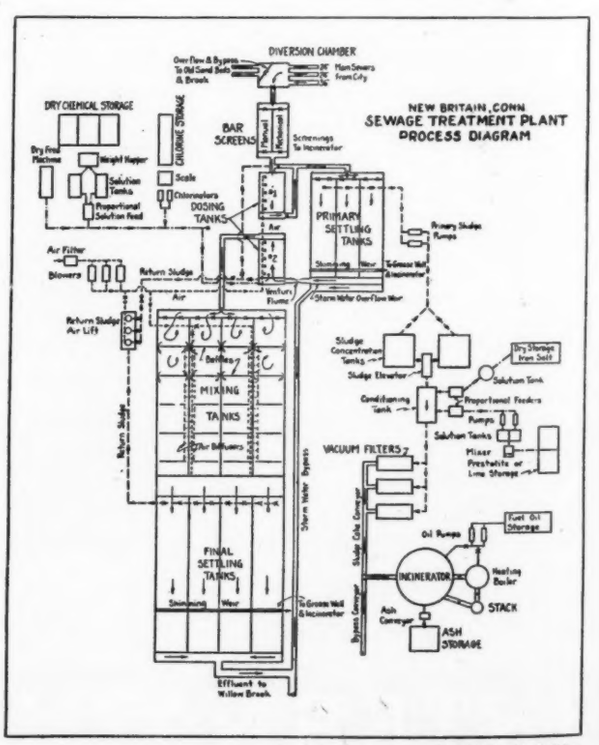
The **Washington, D. C., disposal plant** to go into service this spring, has a capacity of 130 mgd.; includes grit removal, grease separation, sedimentation; sludge digestion, elutriation and dewatering on vacuum filters and disposal on land. It is intended to effect 45% removal of suspended solids and 35% reduction of B.O.D. By-product sludge gas will be used as fuel to operate a 1200 hp. internal combustion engine driving a 1000 kva. generator.[E10]

A **Guggenheim type plant** is going into operation at New Britain, Conn., following operation of an experimental plant since May, 1935. The sewage carries large rapidly varying amounts of iron, copper, cyanides and animal and mineral oils, and wide hourly changes in alkalinity. The state requires an effluent with a maximum of 30 ppm. suspended solids and 50 ppm. B.O.D., necessitating 80% removal. Plant designed for a maximum dry weather flow of 13.5 mgd. and maximum storm flow of 18 mgd. The sewage passes through bar screens, dosing tank (receiving sludge from final tanks), primary settling tanks, dosing tank (receiving chemical coagulant and return sludge), mixing tanks (with spiral air diffusion), and final settling tanks. The sludge from the primary tanks is pumped to concentration tanks (decanted liquid from these returned to raw sewage), thence to sludge conditioning tank (using lime and a ferric coagulant mixed by air diffusion), and by gravity to vacuum filters (filtrate pumped to No. 1 dosing tank); filter cake carried by belt conveyors to Nichols 6-hearth incinerator, hot gases from which are utilized in waste heat boiler. Screenings also are burned in incinerator. Final ash is carried by conveyor to overhead storage. To smooth out irregularities in sewage contents, provision is made to return 2 mgd. of primary tank effluent to the raw sewage. Grease is skimmed from both primary and secondary tanks and burned in incinerator. Rate of chemical dosage is automatically controlled by rate of sewage flow for coagulants, and by rate of sludge flow to filters for conditioning. Principal equipment by Chain Belt Co., Jeffrey Mfg. Co., Filtration Equipment Co., Nichols Engineering & Research Corp. and Bailey Meter Co. Fuller & McClintock, engineers.[H46]

Sewage treatment research in 1936. A review of the literature by a committee of the Federation of Sewage Works Associations.[C27]

Clarification, whether by the action of activated sludge or by chemical or physical change in the fluid, is in large measure the result of flocculation of colloidal materials. Flocculation or coagulation of dispersed material by gas bubbles is mainly physical, although a biological effect is suggested.

Bulking of activated sludge appears to be fundamentally a maladjustment of oxygen supply and oxygen demand. In some cases the aeration rate may be sufficient over-all, but insufficient at the influent end of the aeration tank. This theory seems to explain most diversity of experiences. Apparently, maintaining a proper condition of the return sludge and a proper balance between oxygen demand and supply in the early stages constitute the best control measure; which



Municipal Sanitation

Process diagram of New Britain treatment plant

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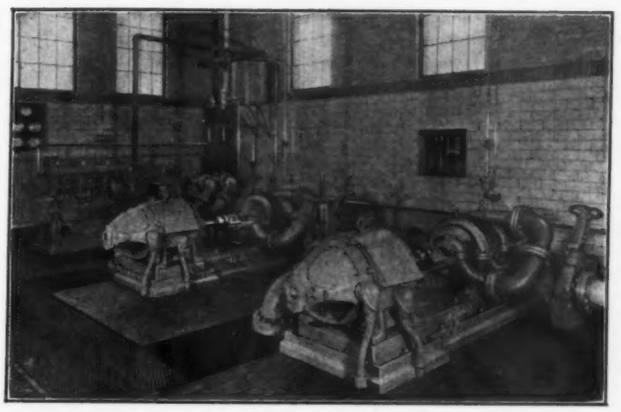

For standby in emergency, Concord, N. H., employs a Sterling Dolphin C-6 cylinder 180 H. P. engine direct connected to a 1000 G. P. M. 310 ft. head Morris centrifugal pump running at 120 R. P. M.

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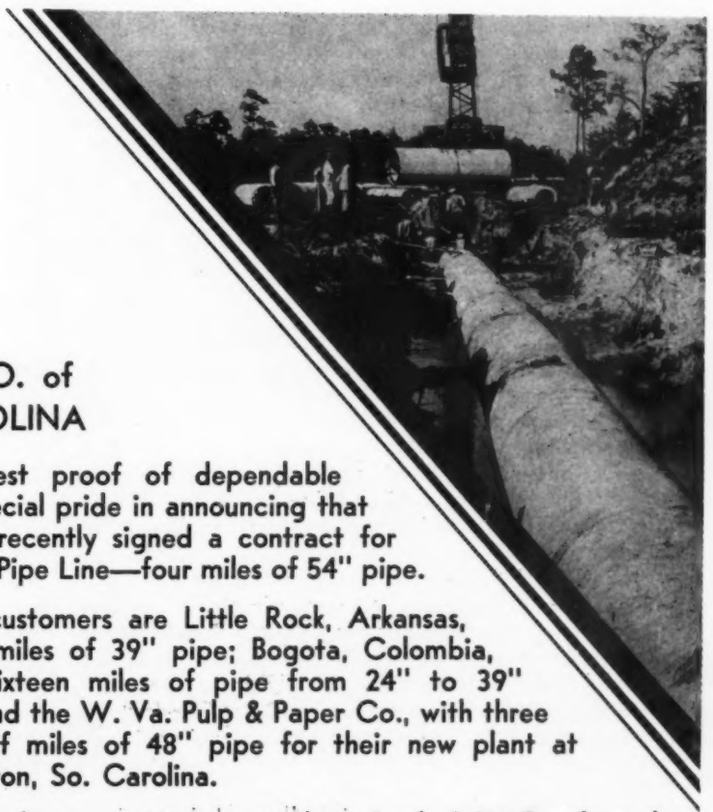

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balance can be maintained either by retarding bacterial activity or increasing the amount of oxygen dissolved. The latter may be difficult with strong sewage and a highly active sludge, and chlorination to retard initial aeration may prevent bulking.

Sludge digestion is effected by biochemical mechanism and agencies. Most of the organic substances go through a definite succession of changes such as degradation of cellulose through the cellobiose and glucose stages, and of proteins through polypeptides-amino acid stages to ammonia. The most important of the intermediate products from the standpoint of quantity and effect are the organic acids, but beyond gross identifications, little work has been done to determine the identity of these. Regarding the agencies responsible for digestion, little of a definite nature is known except that bacteria and their enzymes play an important role in the transformation and stabilization of the organic material. The enzymes are evidently present but their reactions are little known.

Difficulty in digesting activated sludge is due mainly to its low solids content. Mixed with primary sludge it requires large tanks, or decanting in separate tanks; concentration by chemicals does not seem to have been attempted. The difficulty of disposing of the supernatant liquor might be lessened by coagulation.

Advantages are claimed for both horizontal stirring and vertical circulation by means of pumps. The former distributes the raw solids evenly over the surface and brings them into intimate contact with the ripe sludge, which should be an advantage if mixing caused by gas and convection currents is inadequate. Breaking up the scum with stirring mechanisms is important and may accelerate the rate of digestion. Because a certain degree of mixing is beneficial it does not follow that a greater amount will be more so.

Sludge treated with ordinary coagulents and dosages digests somewhat more rapidly and with lower gas yields than ordinary sludge. More experimental data are desirable on the solids concentration and compacting that may be expected, drainability and settleability, and quality of supernatant, as compared with non-chemical sludge.

Activated carbon appears to increase the temperature and pH of digestion tanks, the quantity and quality of gas, and prevent foaming, and odor in the digested sludge.

In using sludge gas for power generation there is a marked tendency toward heavier, slower engine types especially adapted for this service, as contrasted with the higher speed automobile types frequently used in early experimental work.

For holding *chemical solutions* which are corrosive there is increasing use of steel or wood tank with a rubber lining, sheet rubber being bonded and vulcanized in place, or self-vulcanizing rubber liquids or plastics used.

Trickling filter operation at a continuous high rate (20-30 mgad) appears to be practicable if ventilation is adequate. Recirculation of part of the effluent may be advantageous but the added cost of larger settling basins and recirculation pumps must be balanced against value of improved results and against the cost of other processes which produce equal or better results.

Vacuum filtration of sludge digested for various periods up to 160 days was studied at the Baltimore, Md., sewage works and clear indication obtained that the amount of cake obtained by vacuum filtration varies considerably as the sludge digests. The amount of cake decreased continuously during several weeks of digestion, the minimum output occurring when gasification was very active and the sludge was about 60 to 70% digested—possibly because the stirring action of the gas increased the amount of colloids. After the digestion was practically complete the filtration rate decreased greatly, probably partly because of an increase in ammonia nitrogen which requires the use of large quantities of coagulant.[C29]

Pollution of water may be measured as to degree by four methods: dilution B.O.D., direct absorption B.O.D., oxygen consumed from permanganate, and moist combustions. Comparing the first two it was found that the Nordell Odeemeter offers a means of determining B.O.D. values which are quite comparable to those obtained by the dilution method, and in 10 or 12 hours instead of 5 days. Determination by oxygen consumed from permanganate is entirely inadequate in estimating the oxygen demand of trade wastes containing volatile acids and is valueless as an absolute measure of the oxygen demand of polluted water. Investigations of the efficiency of chromic acid, acid potassium permanganate, potassium persulphate, alkaline potassium permanganate and Schollenberger's chromic sulphuric phosphoric acid mixture indicated that the last was the most promising for use as reagent in moist combustions. Moist combustions promise to become useful in sewage determinations; values obtained are reproducible in duplicate and show a certain loose consistency when compared with results given by other tests; but the absolute values obtained must be regarded with some suspicion until further investigation proves that they represent all of the organic carbon and only the organic carbon.[C31]

Partial activated sludge treatment at Croydon, England, has been in service for some time, using three systems of activation—Simplex, "channel" and diffused air, the rate being 6 to 12 times that ordinarily employed for complete treatment and giving about 60% as great reduction. The "activated" sludge was grey in color and had to be returned immediately or it would begin to putrefy; also any variation in the quality of the sewage had a greater effect, there appearing to be little if any reserve store of purifying power. The effluent could be treated on a percolating filter at twice the rate of effluent from sediment only.[D22]

Dairy waste treatment experiments at Ellesmere, England, using activated sludge treatment, and two trickling filters in series, receiving milk washings (which had been stored in an underground brick tank for the breaking up of the organic constituents into simpler substances), led to the following conclusions: When the stored waste was diluted with purified effluent to give a liquid having a B.O.D. of 200 to 300 ppm and treated on the filters in series, the order of which was reversed every three weeks, at the rate of 160 g p d per cu. yd. of combined volume of the two filters, the final effluents had a B.O.D. of about 7.0 ppm, were well oxygenated and contained nitrate; and the filters showed no signs of becoming choked. During 18 mos. of continuous operation the effluent B.O.D. exceeded 20 ppm in only 2% of the samples. In the activated sludge tank, continuous aeration for 24 hrs. of a liquid averaging 350 ppm B.O.D. after storage produced a settled effluent with an average B.O.D. of 5.8 ppm; better results being obtained without dilution; more careful control than with the filters was necessary to give good results.[D24]

Bibliography of Recent Sewerage Literature

c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

C *Sewage Works Journal*

27. Research in Sewage Chemistry, Sewage Treatment and Stream Pollution. Committee report, pp. 135-172.
28. t. Biochmical Oxidation by Sludges Developed by Pure Cultures of Bacteria Isolated from Activated Sludge. By C. T. Butterfield, C. C. Ruchhoft and P. D. McNamee, pp. 173-196.
29. t. Vacuum Filtration of Sludge after Various Digestion Periods. By C. E. Keefer and H. Kratz, Jr., pp. 197-206.
30. t. Studies with Activated Carbon in Sewage Sludge Digestion. By C. L. Walker, pp. 207-223.
31. t. Oxygen Demand Studies. By J. Burtle, pp. 224-238.
32. Progress of Sewage Treatment in New York City. By R. H. Gould, pp. 239-242.
33. Preliminary Operations of the Coney Island Sewage Treatment Plant. By W. Donaldson, pp. 243-255.
34. Design of the Sewage Treatment Works of the Sanitary District of Chicago. By L. C. Whittemore and N. E. Anderson, pp. 256-270.
35. Improvements in Sewage Treatment at Stockton, Calif., as Affected by Cannery Wastes. By C. C. Kennedy, pp. 271-284.
36. Coagulation Contrasted with Chemical Precipitation in Sludge Filtration. By A. L. Genter, pp. 285-292.
37. Gadgets and Kinks, pp. 293-297.
38. Operation Data, Galesburg, Ill., Sanitary Dist. Plant, pp. 297-300.

D *The Surveyor*

March 19

22. p. Partial Treatment of Sewage by the Activated Sludge Process. By F. E. Pipe and J. E. Farmer, pp. 437-440.
23. p. Sewers in Public Highways. By F. V. Appleby, p. 446.

March 26

24. p. Laboratory and Large-Scale Experiments on the Purification of Dairy Wastes. By S. H. Jenkins, pp. 463-464.
25. p. Sewage Flies: Their Seasonal Incidence and Abundance. By L. Lloyd, pp. 465-467.

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26. Adaptation of Small Siphons for Sewerage and Sewage Disposal. By C. D. C. Braine, pp. 491-494.
27. p. Sewage Flies. Discussion of D 25, pp. 511-513.

E *Engineering News-Record*

March 25

10. Sewage Disposal for the Nation's Capital. By F. A. Marston, pp. 431-436.

April 8

11. Severe Damage to Outfall Sewer by Acids, pp. 519-520.

G *Water Works and Sewerage*

April

14. Operating Control Tests for the Activated Sludge Process. By T. R. Hazeltine, pp. 121-123.
15. c. The Rehabilitation of a Badly Damaged Sewer. By W. D. Darby, pp. 130-131.
16. Sludge Disposal by Incineration. By P. B. Streander, pp. 132-136.

H *Municipal Sanitation*

April

46. New Britain Completes Plant of Guggenheim Type. By F. G. Cunningham and H. K. Gatley, pp. 214-220.
47. Observations on Sewage Treatment Abroad. By W. Rudolfs, pp. 221-224.
48. Laboratory Control of Sewage Treatment: Biology of Sewage. By F. W. Gilcreas, pp. 225-227.
49. Status of Wastes Disposal: In Kentucky. By F. C. Dugan; in Wyoming, by L. O. Williams, Jr., pp. 231-232.

I *The Constructor*

April

2. c. Buffalo Intercepting Sewer Project.

J *American City*

April

8. Three Methods of Aeration in One Activated Sludge Plant. By T. R. Kendall, pp. 63-65.
9. New Chemical Treatment Plant for Domestic Sewage and Wastes (Owosso), pp. 66-68.

P *Public Works*

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17. Elutriation Methods and Equipment. By A. L. Genter, pp. 11-14.
18. An 8-Community Sewage Project, p. 16.
19. c. Sewer Construction Under Difficult Conditions, p. 23.
20. A New Pump Control. By J. W. Hood, pp. 37-38.

Large Sludge Pump for Joint Sewage Plant

A large Marlow sludge pump for the Elizabeth, N. J., sewage treatment plant was described and illustrated in our March issue, page 16. The statement was made that this pump had a capacity of 2,500 gallons per minute; this is an error, as the pump capacity was 210 gallons per minute. However, one pump maker reports to us that he has received two inquiries for 2,500 gpm. pumps, despite the fact that the number of places where such large units could be installed are very few and far between.

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Following is a digest of the important articles published last month having to do with water works design, construction and operation and water purification, arranged in easy reference form.

The Water Wheel

Algae growth in river water at St. Joseph, Mo., was controlled by chlorine under some conditions. At Council Bluffs, algae in open reservoirs was controlled by maintaining chloramine residuals of 0.5 ppm. or greater, supplemented with applications of copper sulphate; such residuals also giving improved bacterial conditions in both reservoirs and distribution system. At St. Joseph, ammonia is satisfactory as a preventive for many tastes and odors and as an inhibitor of after growths, while activated carbon is efficient and economical in controlling tastes and odors of short duration. At Council Bluffs, chloramine together with activated carbon does away with much reservoir washing and dead end flushing; chloramine residuals as high as 1.0 ppm. produce no chlorine tastes if enough of the organic matter has been removed by activated carbon before the ammonia-chlorine is applied.[A75 & 77]

Bentonite may be defined as "a natural hydrous aluminum silicate capable of swelling reversibly in water to at least six times its original apparent volume to form a gelatinous mass with the consistency and appearance of grease." Deposits are found in eight of the western states and Canada. Sodium bentonites may be used as coagulants in the treatment of waters having a definite minimum concentration of dissolved electrolytes and reduce their turbidity to zero. With equivalent dosages, bentonite flocs are uniformly more voluminous and more rapid in sedimentation than those produced with alum.[A88]

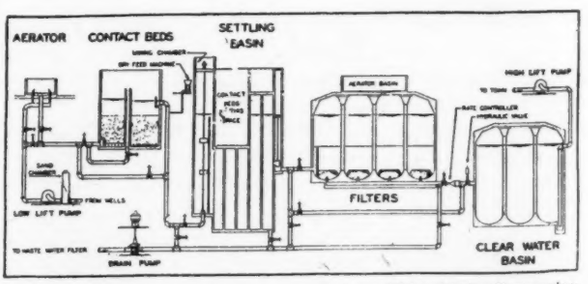
Filter sand permeability is represented in the formula for flow by a coefficient which is a function of the viscosity of the liquid and of the porosity, size, shape and gradation of the granular material. Tests at the Iowa Institute of Hydraulic Research led to conclusions that this coefficient varies inversely as the coefficient of viscosity of the water; as the 6th power of the porosity for angular Iowa river sand and as the 5th power for rounded standard Ottawa sand; and as the square of the diameter of the sand grains; was 50% greater for standard Ottawa sand than for angular Iowa river sand having the same grain sizes and porosities.[E10]

Iron removal and pH correction at Norwood, Mass., where analyses of the well water supply showed more than 10 ppm of iron and corrosiveness, was studied by an experimental plant in 1935, as a result of which a plant was built in 1936 which produces practically iron-free water. Water is pumped from the wells through 20 "Sprayco" full cone spray nozzles, arranged in 4 rows, 2 in each of two basins, set at an angle of 45° so that the two rows of spray are directed toward each other and fall into the basins, from which the water flows to coke beds 4 ft. deep, entering the bottom of one and the overflow from this entering the bottom of a second. From this it flows to a mixing chamber (on the way receiving lime or soda ash), where approximately 15 min. mixing is furnished by two cypress paddles on a vertical shaft; and from this to a settling basin with 1½ hr. detention period; thence onto sand filters. Control of the entire plant except the high-lift pump is automatic, set to maintain the clear-water basin full; and the high-lift pump is automatically stopped if the clear water falls to a low level.[F39]

Corrosion control by deaeration was adopted by the Freeport Sulphur Co. for protecting a steel pipe line in Louisiana which carried sulphur water, after all other methods proved ineffective. Oxygen ran 6 to 10 ppm and at times exceeded 100% saturation. The deaerator consisted of a tank 19′ high packed with wooden slats over which the water trickled in thin films from which the gases readily escaped. The top of this tank was connected to a vacuum pump which maintained a vacuum of 28″ to 28.5″, removing about 95% of the oxygen; the rest being removed by applying sodium sulphite.[G16]

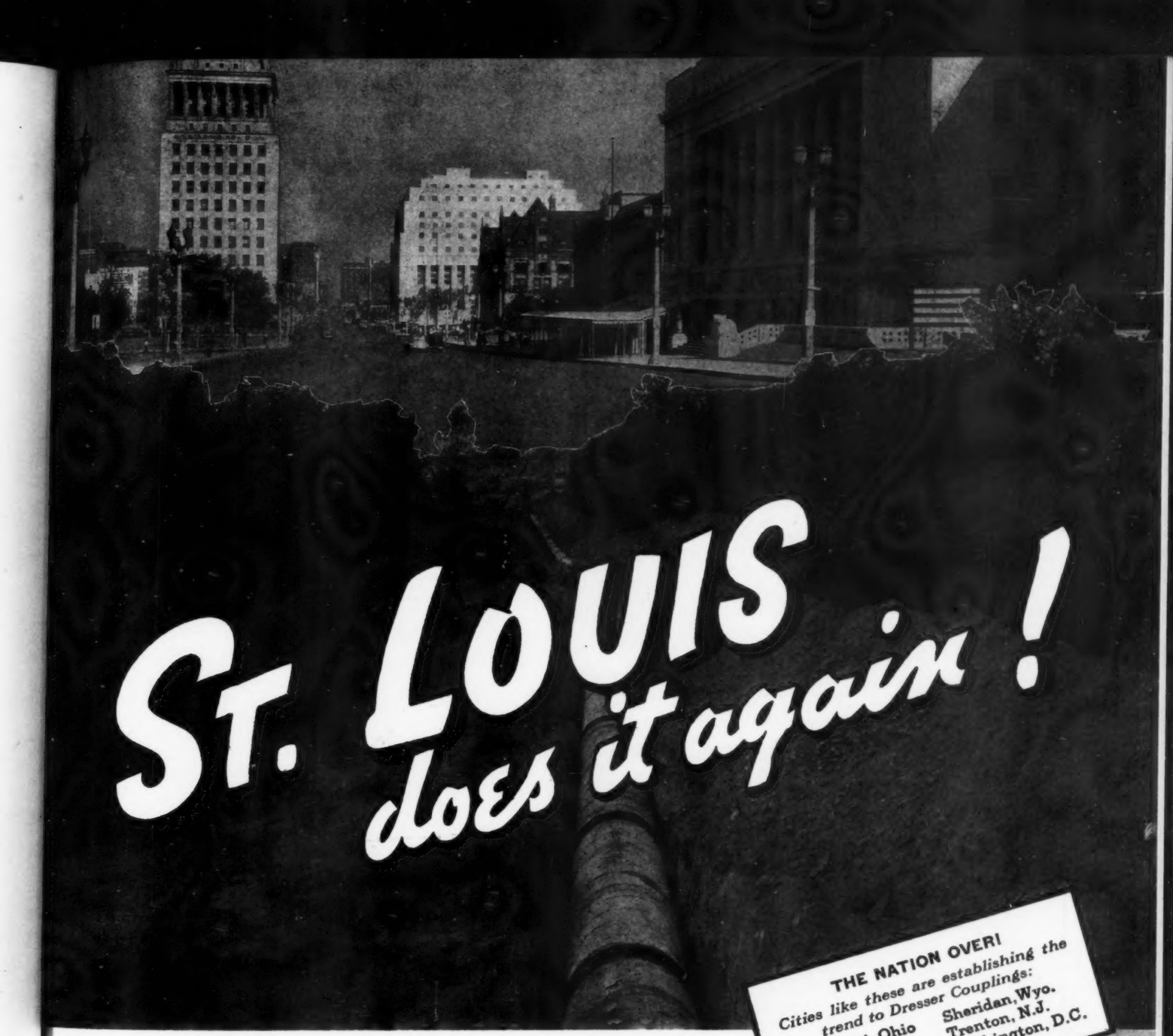
Pilot filtration plant at Cleveland, O., unit A, was started in 1928 to study the merits of granular activated carbon for dechlorination and deodorization—the first such study in this country—with a capacity of 450,000 gpd. Later it was used to study the ammonia-chlorine process; and during the past five years to study a large number of coagulants; and recently to study the possibility of omitting coagulation during 4 to 6 months of the year when turbidities are below 2 ppm, forming an alum mat on the filters after each washing only, and prechlorinating and treating with powdered carbon ahead of the filter. To better carry on these tests, a new experimental plant, "unit B," has been constructed with a capacity of 10,000 gpd, reproducing as nearly as possible the conditions of operation found in the two full-scale filter plants. "Parallel runs indicate the hydraulic characteristics of the experimental units to be identical with those of the regular plant, and consequently capable of conclusions which apply to the larger units.[G19]

Inspecting 36″ mains after laying to locate "holidays" and apply enamel to them and to the unenameled strips at field-welded joints is effected by the Los Angeles Bureau of water works and supply by means of an inspector's car that is introduced through an 11″ x 18″ manhole and passes through 20″ valves, pulls two trailers with an assistant in each up 8% grades, and



Water Works Engineering

Diagrammatic layout of Norwood, Mass. plant



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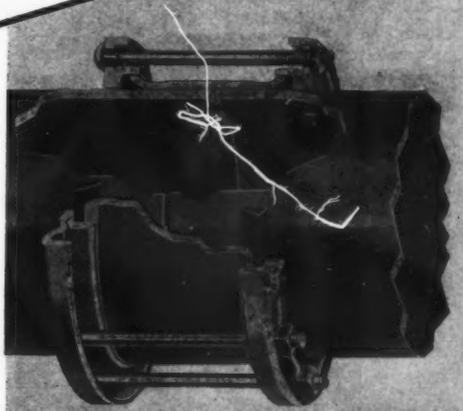

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operate wire brushes with a 10,000 volt current. The car travels on three wheels, with a canvas seat swung between the two rear ones and dropping 2″ below them so as to just clear the pipe bottom. Two storage batteries and the steering wheel are between the inspector's legs, and the brush wheel (which can be folded like an umbrella when not in use) is just ahead of his feet. The whole thing can be disassembled for passing through a manhole, and folded up sufficiently to go through a 20″ valve. When a spark indicates a defect in the enamel, the assistant in the trailer locates it exactly with a hand brush and applies enamel to the spot.[E9]

Gauge connections may result in erroneous readings under more or less usual conditions. Projections up stream or down stream from the pressure opening, such as offsetting of pipe bores at a flange connection, were shown by tests to give pressures varying from each other by as much as 4 ft. when these were taken at the four quadrant positions in the pipe flange. However, when the pressure openings were located 3 5/16 inches from the face of the flange, the four readings never varied by as much as a foot. Projections due to roughness in the casting would undoubtedly produce similar errors. Such erroneous readings might cause serious errors in testing pumps.[A82]

Softening water for a town of less than 1,000 population (Glidden, Ia.), and raising pH from 7.0 to 7.8, costs about $1,750 a year, including overhead—less than the estimated saving in soap alone. Water is from wells; total hardness 400 + ppm, practically all carbonate. For softening, zeolite process adopted as it cost less to construct, 25% less to operate, automatic in operation, no problem of sludge disposal, and filtration would serve no other purpose. Two-unit plant of 100 gpm capacity cost $9,500, chemical feeders and everything else included. Street and water superintendent attends to it at one daily visit, placing 9 lb. of sodium silicate and 12 lb. of caustic soda in the chemical feeder.[A83]

Lowering a 24″ main in Portland, Me., for a length of 700 ft. (thirty-five 20′ lengths) was done as follows: A trench 3′ wide and 5.5′ deep was dug alongside the main; then the earth was removed from under the pipe, leaving a pillar of earth 18″ long under each joint, down to the final grade. Beginning at one end of the line, earth was removed slowly under the first 12 joints until the pipe had dropped about 3″; then the same was done at the next 12 joints, and finally at the last 11 joints; and this was repeated until the pipe was resting on the bottom. As the line had curved slightly upward, it curved more or less horizontally in settling, the joints being allowed to move as they wished. The joints had been made with leadite or hydrotite. When the pipe was uncovered two joints were seeping slightly, which increased slightly when the pipe was lowered (pressure was maintained in the line throughout the work) but all the others stayed tight, although there was slight surface chipping at most of them.[V3]

Ferric chloride was substituted for alum at Emporia, Kans., for water carrying turbidities so finely divided that excessive doses of alum were required. To use the alum solution tanks for ferric chloride, they were given a coat of bituminous paint followed by a thick coat of asphalt, and the solution was discharged through a 1½″ rubber tube. The change has corrected coagulation difficulties, due largely to the rapidity of floc formation of the ferric chloride; drayage charges and storage

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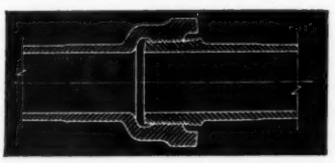

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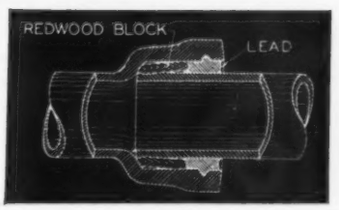

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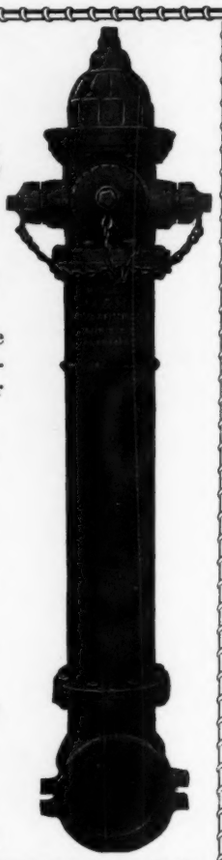
space has been reduced more than 50%; the cost of coagulation is reduced about $1.00 per million gallons; wash water is reduced 40% and the chemical and esthetic qualities of the finished water have been improved.[G11]

Filter underdrains of porous plates (Aloxite) have been tried in old filters at Denver, Colo., replacing screens in cast iron holders. Plates 1¼" thick entirely covered the bottom, with an asphaltum compound in the joints. After 7 months' operation the plates of one filter were treated with a 3.3% solution of sodium hydroxide (apparently unnecessarily). "The first 9 months' operation of the Aloxite plates indicates that these plates will make a very satisfactory underdrain for filters, provided the raw water is properly treated and the filter material is of proper size and deep enough to prevent any appreciable amount of the suspended matter in the coagulated water or fine floc from reaching the plates." Their use gave a much more uniform wash and relieved the mud ball situation, and does away with the necessity of gravel beds.[G12]

Algae removal from lake water at Portland, Me., by means of a Loughlin magnetite filter is being tried out. The Water District built an iron tank 10x1.5 ft. x 4 ft. deep, for which the Filtration Equipment Corp. furnished a solenoid-cleaned filter similar to those used in sewage plants. "The results up to date have been very favorable. Three-quarters of the vegetable matter has been taken out of the water at a high rate of flow." Experiments with upward and downward flow and various thicknesses of sand bed are being continued.[V4]



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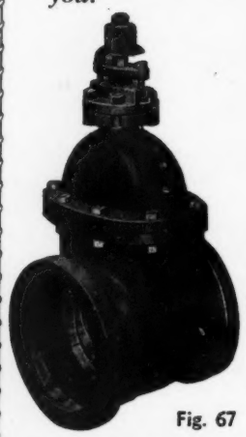

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Fig. 67 Fig. 29H

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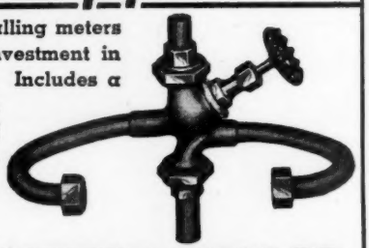

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Bibliography of Recent Water Works Literature

c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

A *Journal, American Water Works Ass'n*
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80. Uniform Marking of Fire Hydrants. Committee report, pp. 449-450.
81. Specifications for Fire Hydrants. Committee report, pp. 451-457.
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5. Water Supply Engineering. Committee report, pp. 693-702.

L *Civil Engineering*
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9. Planned Utilization of Water Resources. By A. E. Morgan, pp. 255-259.
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3. c. Lowering 700 feet of 24-inch Cast Iron Water Main. By M. O. Thorne, pp. 40-43.
4. The Algae Strainer. By H. U. Fuller. pp. 43-46.

Controlling and Eradicating Weeds Along Roadsides

WEEDS may be classified into four general groups: *Annuals*, which are plants that complete their growth and die in one year, depending upon seeds for reproduction. These include ragweed, wild oats, Russian thistle and puncture vine. *Winter annuals* have seeds that germinate in the fall and complete their growth the following spring. Examples are Chickweed and Shepherd's purse. *Biennials* require two years to complete their growth, seeding the second year. These include burdock, wild carrot and bull thistle; most biennials propagate by seeds. *Perennials* live three or more years and reproduce from both seeds and roots. Examples are dock, oxeye daisy, Canada thistle, Johnson grass and bindweed.

Annuals, winter annuals and biennials can be controlled and finally eradicated by preventing them from going to seed. To control perennials, the roots must be killed, but preventing seed formation will help confine them to a limited area. The above information and following data on methods of control are abstracted from an article in *Public Roads*, which is published by the Bureau of Public Roads of the U. S. Department of Agriculture.

Usual methods for controlling weeds include mowing, burning, blading, dragging, hand pulling, hoeing and killing with chemicals.

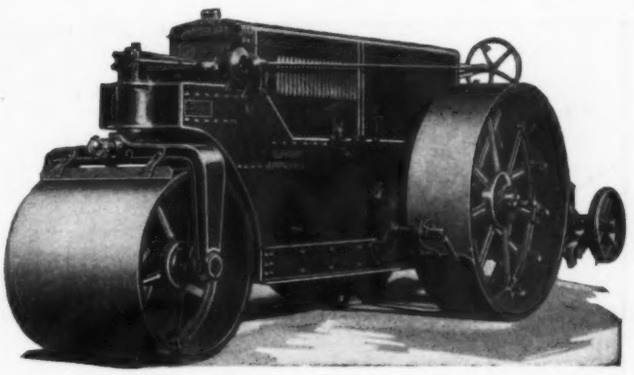
Mowing

Timely mowing is an effective method of controlling most annual weeds. By thus preventing seeds from maturing, their only means of propagation is destroyed. Mowing is the most practical method of discouraging objectionable weed growth and encouraging desirable permanent types of vegetation on roadsides and large areas where funds for weed eradication are very limited.

Complete eradication of perennial weeds by mowing is difficult, and satisfactory results are obtained only by monthly cuttings during the growing season over a period of years. Mowing often enough to prevent the formation of seed will confine the perennial weeds to a limited area.

As a rule, the best time to mow is as soon as the weeds have reached the bloom stage. It is a general custom to leave the mowed vegetation on the ground to dry. The flowers of many plants persist for a considerable period of time, and in the latter stages may contain mature seeds, or seeds that have developed far enough to mature. Therefore early destruction is necessary to prevent reseeding. The time of cutting varies; patrolmen, and town and county engineers should be, and generally are, sufficiently familiar with local conditions to schedule mowings at the proper time.

Weed control demands early mowing, and also several mowings. In addition, there should be a general mowing and clean-up in the fall to prevent formation of drifts in the north, and clogging of ditches and culverts



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This modern unit with a powered pump helps you do a better job of surface treatment, skin patching, pot hole and penetration patching, shoulder dressing, curve relocation or widening work. Use either the spray bar on rear or as many hand sprays as you need. Any tar, asphalt, cutback, emulsion or road oil works fine in this outfit. Save on time and on material costs by buying material in bulk. Write, today, for prices.

The Littleford No. 101 Utility Sprayer has twin burners and U type heat flues. Sizes 300 to 1200 gallons for two or four wheeled trailer or truck mounting. Your choice of either 50 or 100 G.P.M. pump with air cooled driving engine. Ask for Bulletin K-5.

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in all sections. Two or three mowings a year over the entire right-of-way and probably as many more on the shoulders only, are desirable for weed control and appearance.

The equipment used for the mowing operation includes truck- or tractor-drawn hay mowers, power mowers, ordinary horse-drawn farm mowers, and hand scythes. When mechanical mowers are used, weeds around headwalls, guard rails, fences, signs, highway markers, and other obstructions where the mechanical unit cannot be used are cut by laborers using scythes.

Recent designs for highway cross sections have features, intended primarily to improve roadside appearance, that greatly facilitate mowing. Flatter slopes and rounded shoulders, gutters, and ditches have made a greater portion of the rights-of-way accessible to mechanical mowers.

Cooperation between maintenance personnel and roadside improvement engineers is essential for economical roadside development. Volunteer growth that will develop into good shade or ornamental trees can be saved during the mowing operation if they are properly identified. Arranging roadside plantings so that weeds can be cut with a minimum of hand work helps materially in developing roadsides without increasing expenditures for grass and weed cutting.

It may be preferable to mow roadside weeds frequently, leaving the cuttings on the right-of-way. Where tumbleweeds are removed from shoulders primarily to prevent snow drifts, cutting to pieces with a disk harrow has been satisfactory. Leaving vegetation to decay increases the fertility of the soil and eliminates damage from burning provided accidental burning does not occur.

Burning

Weeds can be burned with a flame while they are green; as they stand after forming seeds; in piles after being cut; or after being sprayed with gasoline, oil, or other herbicides. Adequate control is assured if both plants and seeds are destroyed. The principal objections to burning are the fire hazard, particularly in timbered and grain-raising country, and the hazard to traffic from blinding by smoke.

To be effective, burning should give the vegetation a thorough scorching. The great amount of heat required makes burning impractical on large areas of green weeds over 6 inches high.

Burning is a method of last resort applicable to roadsides on which weeds have been allowed to mature a crop of seeds. Dry weeds with attached seeds are best burned as they stand. Mowing before burning merely scatters the seeds and those on the surface of the soil are seldom exposed to a sufficiently high temperature to be destroyed.

After mowing dense vegetation or weeds that are beyond the full-bloom stage, it is advisable to pile and remove them from the roadside to prevent clogging of drainage facilities and the ripening of seeds starting to mature. Burning the piles when dry is the cheapest method if it can be done without injuring desirable growth or causing unsightly scars along the right-of-way.

Blading, Dragging and Hand Pulling

Blading or scraping with a grader is inexpensive, and is effective on young weeds, but after seeds are formed serves only to make matters worse. Not all the right-of-way can be reached. Dragging, employing

various types of equipment, is effective in removing tall weeds, and does not generally injure grass, but is not effective in weed control, tending rather to spread the seeds. Hand pulling and hoeing are very effective, but too costly for any but limited or special areas. The best time for pulling or eradicating with a hoe is when the weeds are in blossom and the ground moist.

Smothering by means of grass, plant, vine or shrub that has no undesirable features and is hardy is sometimes possible. Native perennials and annuals are best for this, the type depending upon local conditions and climate. These may include: Native vines, Japanese honeysuckle, wild grapes, dwarf flowering locust, low forms of sumac, and even dwarf varieties of cacti. In addition to increasing the esthetic benefits, such plantings should have as their objective a reduction in maintenance expenditures.

Control by Chemicals

The use of chemicals for controlling weeds has been developed mainly in agricultural research, and it is doubtful if highway maintenance departments have any adequate realization of the possibilities of this method. One political subdivision reports that the use of chemicals on roadsides, over a 4-year period, has made it possible to reduce expenditures for weed control to one-sixth of the amount formerly spent when only cutting and mowing were employed.

Among the chemicals used are ammonium sulphate, ammonium thiocyanate, copper sulphate, iron sulphate, arsenic compounds, sulphuric acid and chlorates. The first two are so expensive as to preclude their use on all but small areas. Copper and iron sulphates, applied as a spray, are effective on dandelion, wild mustard, wild radish; the latter also on buttercup, checkweed, etc. Application should be on humid days; rain within a few hours will wash off the chemical requiring another dose. When using iron, four to six applications are necessary—the first in early spring, and the others 10 days to two weeks apart. The dosage is about four or five pounds per 1,000 square feet.

The principal objection to arsenic and its compounds is that they are very poisonous to both man and beast. When sprayed upon weeds they give them a brackish, sweet taste that is attractive to grazing animals. The greatest care must be taken not to inhale the dust or fumes or to bring the hands near the face or mouth while using this chemical.

A few years ago the use of arsenic sprays was replaced to a great extent by much more expensive sodium chlorate solutions to eliminate the danger of poisoning livestock. During the last year or two arsenicals have come back into more general use because of the development at the University of California of an acid arsenical solution and improved knowledge of its use.

The method of preparing and applying the acid arsenical solution as given by L. W. Kephart, senior agronomist of the United States Department of Agriculture, is becoming standard practice because of the low cost and the relatively high efficiency in killing very troublesome perennial weeds. This method is as follows:

Stir the following solution until dissolved—

White arsenic	4 parts by weight.
Caustic soda	1 part by weight.
Water	2½ parts by weight.

When required for use add 1 part by weight of the solution to 100 parts of water. After mixing thoroughly, add 5 parts by weight of a commercial grade of sulphuric acid slowly while stirring constantly.

It is highly important that the plant be in proper condition to take the chemical into its tissues when the

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spray is used. This condition occurs when the plants are wilted after hot, dry weather, but when the atmosphere is moist so that evaporation is not high. Under such conditions, a solution sprayed on the foliage is taken up by the leaf tissues and drawn downward into the stem by reason of the negative pressure within the plant cells. The acid in the solution makes the leaf surfaces more permeable. Broad-leafed weeds are affected to a greater extent than grasses.

In practice it has been found that the best kill is obtained when full-grown plants are sprayed towards night after a few hot, dry days. Several authorities recommend the addition of 3 or 4 pounds of soap to each 100 gallons of solution for waxy-coated foliage where the spray has a tendency to collect in drops.

While arsenic makes soil very toxic when applied in large quantities, as in the root-absorption method, the amount required for the leaf-absorption method is so small that no ill effects to the soil can be detected after several applications.

A dilute solution of sulphuric acid is efficient. It does not dry up in hot weather before killing; rain 2 or 3 hours after application does not destroy its effectiveness. Care in handling and application is necessary, but it does not injure the soil nor affect animal life. Usual practice is to spray young plants with a 3% to 10% solution, using 50 to 100 gallons per acre. Application does not affect seed germination. Special sprayers are needed to resist corrosion.

The chlorates are probably most widely used for weed control; of these, sodium chlorate is generally used. The chief objection to their use is the fire hazard, since a mixture of the chlorate and organic matter is highly inflammable; but the chemical itself is neither inflammable nor explosive.

One method of reducing the fire risk is to mix sodium chlorate solution with chemicals of high water-absorbing ability such as calcium chloride or with other non-oxidizing chemicals of good herbicidal power, the latter acting as a diluent and fire preventive when in contact with organic material. Calcium chloride and sodium carbonate are the two substances most commonly used with sodium chlorate in commercial herbicides. The chief function of the calcium salt is to reduce the fire hazard by absorbing moisture from the air, although the claim is made that it improves the herbicide by preventing the solution from drying on the leaves and blowing off.

Dr. W. H. Cook recommends the following herbicides as being safe at relative humidities of 40 percent and no more than doubtful hazards at 30 percent relative humidity. Proportions of all chemicals are on an anhydrous basis.

1. One-half sodium chlorate plus one-half calcium chloride.
2. Two-thirds sodium chlorate plus one-third magnesium chloride.
3. Two-thirds barium chlorate plus one-third calcium chloride.
4. Two-thirds barium chlorate plus one-third magnesium chloride.

The toxicities of these four mixtures are 33.5, 48.3, 34.2, and 32.9 percent, respectively. To obtain solutions with the same herbicidal power that sodium chlorate alone has, the total amount of chemical per 100 gallons of solution must be approximately doubled if the second combination is used and tripled when the others are used.

The following precautions should be taken by the operators using solutions of sodium chlorate:

1. While spraying, use rubber boots. Clothes saturated with

the solution should be well rinsed before they dry.

2. After using pails or other utensils, wash them out thoroughly before setting them away.

3. Trucks, wagons, and other equipment being used should be washed off 2 or 3 times a day, particularly in warm weather.

4. Do not smoke while handling chlorates.

5. Warn the public as to the danger of walking through treated areas by placing "KEEP OFF" notices. After 2 or 3 rains have fallen most of the fire hazard will have been eliminated.

Best results are usually obtained by application while the foliage is fully developed and the plants are still growing vigorously. Sprayed plants should not be burned or cut immediately after the solution has been applied. Burning destroys the chlorate and cutting prevents the roots from being poisoned.

It is impossible to determine in advance just how much chlorate will be required. The amount varies with climate, soil fertility, root growth, and soil texture. A fibrous rooted annual or biennial requires less chemical than a perennial with a deep, underground root stock. It is general practice to spray a solution containing 1 pound of sodium chlorate per gallon until the leaves are well covered. This requires from 100 to 200 gallons of solution per acre.

The present tendency in the use of sodium chlorate is toward dry applications. Though most results indicate that sprays are somewhat more effective, they are always much more erratic than the dry applications. Applying pure sodium chlorate on the ground after removing the mowed weeds would be safe almost anywhere. Besides eliminating the fire hazard, other advantages of this method are: (1) No spraying equipment is required; (2) it is not necessary to prepare a solution or transport large quantities of water; (3) the cost of application is reduced; and (4) only one application is usually required. The principal drawback to dry applications at present is the lack of good distribution equipment for large areas. Chlorate either dry or as a spray has been ineffective on alkali soils. The character of the soil is an important consideration, especially for dry applications. Better results have been obtained on soils of medium texture than on sandy or heavy clay soils.

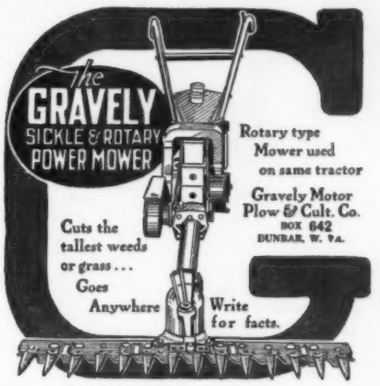
Oils

All oils are destructive to vegetation, but the mineral oils are the only ones cheap enough for general use. Coal-tar creosote oils sometimes sold as "crude carbolic acid" are excellent weed killers for small areas but are too expensive for large-scale operations. The most promising of the oils tested for weed control are those least refined, such as crude oil, waste cylinder oil, and Diesel oil.

Usually oils are applied at the rate of 300 to 400 gallons per acre—a quantity sufficient to cover the vegetation and soil with a thin film. A spray pump providing a pressure above 80 pounds is recommended. Rubber parts of the spray outfit, readily attacked by oil, should be replaced by metal wherever possible.

Damages for Breach of Subcontract

A contractor breached a subcontract by which it agreed that if it was awarded a village contract for the installation of filter equipment, its subcontractor was to furnish all materials and labor covered by a certain section of filtration specifications at a certain price. The subcontractor sued for the breach and was awarded nominal damages. On appeal the Illinois Appellate Court held, International Filter Co. vs Allied Contractors, Inc., 5 N. E. (2d.) 615, that the subcontractor was entitled to the difference between the contract price and what it probably would have cost to complete the contract. A new trial was granted.



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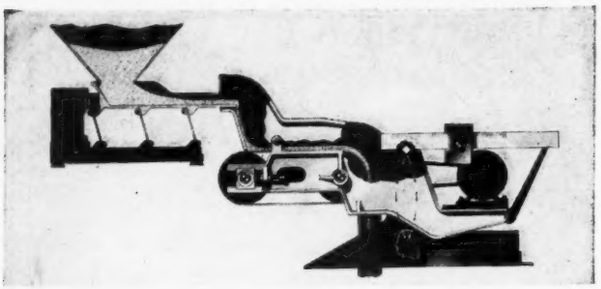
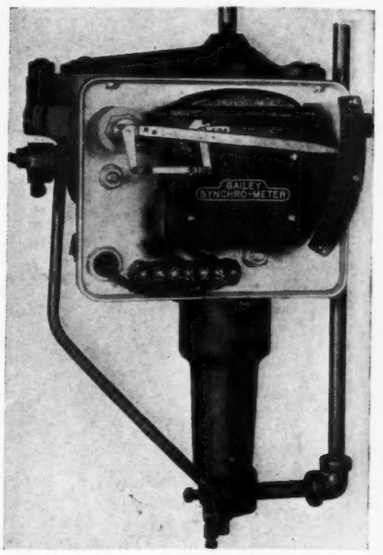




Left, Jeffrey Precision Feeding and Weighing Unit. Right, Bailey Synchro-meter Transmitter, Ledoux bell operated with cover removed to show pointer and Synchro - meter unit.

Jeffrey Precision Weighing and Feeding Machine

A machine applicable to the processes of continuous weighfeeding, proportioning and batching, called the "Waytrol," is announced by the Jeffrey Manufacturing Co., Columbus, Ohio. This machine combines these three features conducive to accurate feed: (1) All-electric vibrating feeding . . . (2) a synchronous weigh-belt on a scale beam so pivoted as to receive material at the most sensitive end . . . (3) automatic all-electric control sensitized through a device called the Electric Brain.

On this unit feeding and weighing are physically separated processes. Furthermore, the rate of feed to the weigh-belt, which travels at constant speed, is in no way dependent on the volume of material handled, but is governed directly by weight through the Electric Brain, which registers any slight unbalance of the belt, and makes instant correction by speeding up or slowing down the vibrating feeder. For dustless operation and to avoid the possibility of error caused by wind pressure, the entire unit is enclosed in steel and glass. It operates from any standard 60-cycle lighting circuit.

Waytrols are available in sizes handling a few pounds up to many tons per hour. The smallest will handle granular material weighing 100 lbs. per cu. ft. at a rate that can be varied from several pounds to a maximum of 4,000 lbs. per hour. All will weigh to within 1% of absolute at least. Jeffrey Bulletin No. 644 describes the machine and its applications in detail.

Gledhill Road Shaper

Gledhill Road Machinery Company, Galion, Ohio, has announced a Road Shaper in 10-ft. working width.

Heretofore the road shaper, while made in two different weights — was available in only one width—7 ft. The 10-ft. width is designed for working a 20-ft. road in one round trip, on blacktop, and road stabilization.

As with the 7-ft. size, the new 10-ft. Shaper's weight can be raised onto the pneumatic tired wheels for transportation. For long distance hauls the Shaper is so made that the total width of the assembly can be reduced to seven feet by a simple dismounting and rearranging of some of the parts, when it can be drawn behind an automobile or truck.

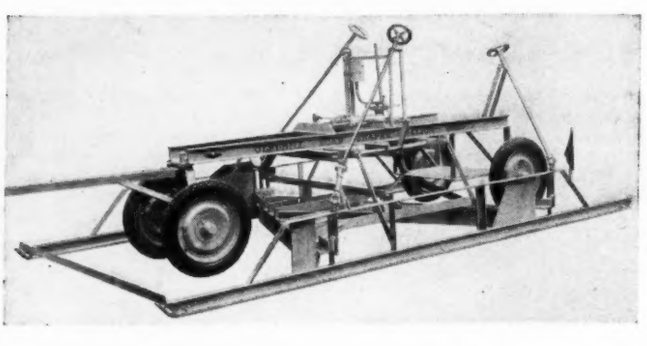
New Alternating Control Panel for Pumps

This new alternator panel made by the Allen-Bradley Co. consists of 3 control relays, used in connection with a set of control circuit fuses, two automatic starters, and a 2-wire pilot control device such as a float switch, pressure switch, high pressure gauge, etc. Optional equipment includes 1 or 2 starter disconnect switches; and "automatic-off-hand" lever switch to permit selection of automatic or manual operation or "off" position; an additional 2-wire pilot control device to permit operation of both starters simultaneously if and when necessary; 2 lever or selector switches, each with 2 "on" positions and one "off" position to permit greater flexibility of operation when using an individual starter disconnect switch for each motor starter and also using 2-wire pilot control devices.

Electrically-operated Flow Meter

A new electrically-operated flow meter, the Synchro-Meter, has been developed by Bailey Meter Company, Cleveland, Ohio. Basically, the Synchro-Meter consists of a transmitting unit which is operated by a Ledoux bell flow measuring mechanism of the type used in standard Bailey mechanically-operated fluid meters, and a receiver consisting of the indicating, recording and integrating instruments. The transmitter is located at the point of measurement of the variable and the receiver is located at a place or places convenient for obtaining readings from the instruments as frequently as desired.

Three wires are required to connect the transmitter to the receiver. With the use of No. 12 wire the transmitter may be located approximately one mile from the receiver. If larger wire is used, a greater distance is allowable providing the loop resistance does not exceed 20 ohms. Bailey Synchro-Meters require the use of alternating current of from 95 to 125 volts, and at a frequency of 25, 50 or 60 cycles.



The Gledhill Road Shaper is now available in 10 ft. width.

Chemical Feed Calculator:

A right handy gadget, a kind of circular slide rule, is available on request from Industrial Chemical Sales Div., 230 Park Ave., N. Y.

Public Works Construction:

A bulletin pictures and describes such construction projects as pipe lines, station piping, equipment installations, water treating plants, irrigation systems, penstocks, swimming pools, refuse incinerators, sewage disposal plants, bridges, buildings and steel structures of all kinds. Copies are available either through this magazine, or by addressing the Pittsburgh-Des Moines Steel Company, 3456 Neville Island, Pittsburgh, Pa.

Centrifugal Pump:

A new bulletin on double-suction horizontally-split centrifugal pumps describes a design that has developed high efficiencies over wide ranges of capacities for each size. The bulletin outlines the features of impellers and casings that have improved the hydraulic efficiencies; and the machining and finishing processes which have improved mechanical efficiencies. Copies from Morris Machine Works, Baldwinsville, New York. Ask for Bulletin 164.

MUD-JACK METHOD

Sunken concrete slab is raised to correct grade by the Mud-Jack Method — preventing breakage of the slab and eliminating reconstruction costs.

Increase the life of concrete slab by the Mud-Jack Method. Write for information about economical maintenance of curb, gutter, and sidewalk slab.

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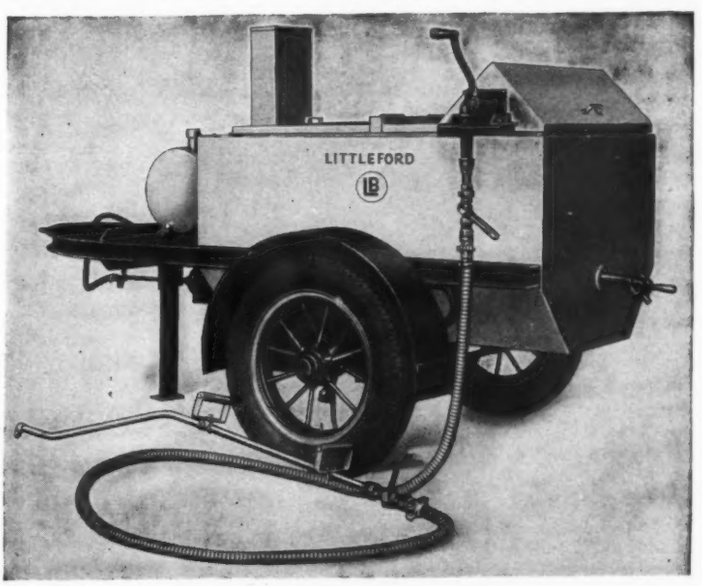
Why Road Men Prefer This Kettle



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Littleford No. 84-HD "Double Heat Circulation" Kettles make double use of the heat from the burners. Quicker draw-off gives you more heated bitumen per day.

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Double use of heat saves up to 30% on fuel. Less wasted heat. Saves up to 30% in labor.

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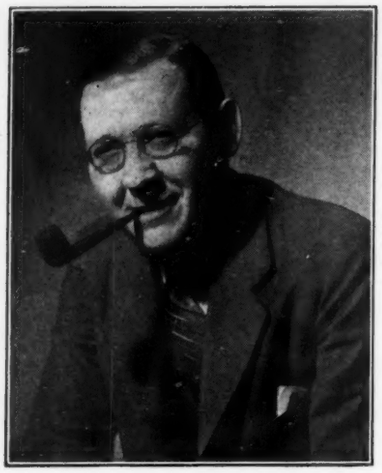
When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 55-57



Paul C. Nordloh

Paul C. Nordloh has been appointed advertising manager of Cleveland Tractor Co., Cleveland, Ohio. Mr. Nordloh for the past three years has been with Deere & Co., and previously had a wide experience in advertising work.

W. R. Odor, formerly assistant sales manager of the Lynchburg Foundry Co., Lynchburg, Va., has been appointed Western Sales Manager, with headquarters in Chicago. J. C. Barksdale has been made New York Manager, having been formerly Works Manager of the Lynchburg plant. C. H. Spencer is now in charge of the Chemical Castings Division.

J. H. Fedeler has been appointed sales manager of Filtration Engineers, Inc., with offices at 858 Summer Ave., Newark, N. J.

W. C. Slee has been appointed assistant Engineer-Director of the American Road Builders' Association.

C. B. Cruger has been appointed sales representative for the states of Indiana, Ohio and West Virginia (headquarters Indianapolis) for the M. & H. Valve and Fittings Co., Anniston, Ala.

News and Booklets

A Small Concrete Pump:

Chain-Belt Co. has brought out a pumpcrete of small size, mounted on pneumatic tires for easy towing. The rated capacity is 15 to 20 cubic yards an hour, and it will pump concrete through a 6-inch pipe up to 800 ft. horizontally or 100 ft. vertically. Excellent 52-page booklet on request.

New Fuel Induction System:

A new fuel induction system for internal combustion engines has recently been patented by Continental Motors Corporation. This new feature, which assures uniform delivery of fuel to each cylinder, is now being incorporated in the majority of Continental engines.

By dividing the fuel mixture for the various cylinders, before making any horizontal bends in the intake manifold, each cylinder receives the same amount of fuel thereby eliminating roughness due to uneven power strokes. The split manifold which is used, eliminates the disturbing influences of centrifugal force and a balanced mixture of uniform density is obtained.

Hoists and Dump Bodies:

This 36-page catalog of Anthony dump bodies and equipment should be a useful reference manual. Contains a lot of information on weights of bulk materials, per ton and per cubic yard; also body dimensions, etc. Sent on request to Anthony Co., Inc., Streator, Ill.

Rippers, Cranes and Scrapers:

Action pictures show LeTourneau Rooters ripping 20 to 29 inches deep through rock, shale, clay, frozen soil. "Loads Lifted" gives pictures, facts and figures on LeTourneau tractor cranes used for steel erection, pavement breaking, industrial hoisting, construction, etc. Model "U" LeTourneau Carryall Scrapers, increase earthmoving capacity. Sizes 18, 12, 9 and 6 yards. Any or all on request to R. G. LeTourneau, Inc., Peoria, Illinois, and Stockton, California.

New Hercules Engines:

Hercules Motors Corp., Canton, O., has added two new 6-cylinder engines, the QX Series. One is 3⅛ in. bore, the other 3¼ in.; otherwise they are generally identical. The smaller, QXA, has a maximum torque of 130 ft. pounds at 1,000 rpm., and develops 55.5 hp. at 3,000 rpm. The QXB has 135 ft. pounds of torque at 1,000 rpm., and develops 60 hp. at 3,000 rpm.

New White Motor Trucks:

White Motor Co., Cleveland, O., has announced a new low price light truck of 1 to 1½ ton capacity, in two models, one a tractor. This truck, the 700 Series, is available in wheelbases from 136 to 196 in., and with many interesting and valuable features.

Diesel Power:

Bulletin 3600-A1, Fairbanks, Morse & Co., describes Model 36 power units, from 10 hp. up, 2-cylinder, and also in 4, 6 and 8-cylinder units. This is a medium speed, 4-cycle engine designed for basic power unit. Bulletin sent on request.

Bituminous Distributors:

The newest bulletin—and a nice one—on an essential in constructing good low cost roads. Ask for Bulletin AD1673. Austin-Western Road Machinery Co., Aurora, Ill.

Flow Meters:

Brown Instrument Co., Philadelphia, Pa., has issued catalog 2004, which describes and illustrates the construction and operation of indicating, recording and integrating meters, in both electrical and mechanical types, and also the Brown Air-o-Line flow and liquid level controllers. Copy on request.

Nearly One Hundred Years of Hardinge Patent History:

With the granting of the one hundred seventy-fifth patent, the Hardinges complete nearly a century of inventive achievement, with an average of more than two patents a year, covering the period from the first patent No. 85584, applied for in 1868, issued to Sarah L. Hardinge, to the first patent No. 382976, applied for in 1887, issued to H. W. Hardinge, on through to No. 1352965, applied for in 1916, which was the first patent issued to Harlowe Hardinge, down to the year 1937, when later patents were issued.

The record is unusual not alone because of the value of their contributions to industry, and that it represents three generations, but chiefly because statistics show that only about 5% of patents issued pay their costs, whereas these patents form the foundation of an industrial company exclusively owned and managed by the inventors.

Acipco News:

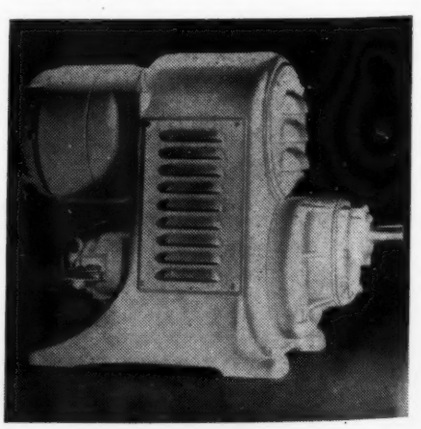
The American Cast Iron Pipe Company announces the opening of their new and enlarged Medical Department at their Birmingham plant, on April 28th. This clinic provides both medical and dental service for approximately 1,000 "Acipco" employees and their families.

Mechanical Flow Meter:

Cochrane Corp., Philadelphia, Pa., publication 2094, describes the Cochrane mechanical flow meter for measuring water and gases, describes action, with charts, etc. Sent on request.

Road Building With Caterpillar:

The illustrations tell the story of "Caterpillar" track-type tractors and road machinery at work in all corners of the globe in road construction. A feature of the booklet is the tracing of the construction of a pioneer road from start to finish—from removing trees and stumps from the right of way to finishing the dirt road with a Diesel tractor and blade grader. This booklet, Form 4046, on request. Write Caterpillar Tractor Co., Peoria, Illinois.



The Upright Varidrive-Syncrogear motor made by U. S. Electrical Motors, Brooklyn, N. Y., shown above is useful for many purposes.

Readers' Service Department

CONTINUED FROM PAGE 56

These booklets are FREE to readers of PUBLIC WORKS.

Cast Iron Sewers

385. For use in wet ground to prevent infiltration, for crossing under railways and heavy duty highways, and for all other sewer construction where replacement, repairs or reconstruction would be costly, cast iron pipe is most economical. For details, specifications, etc., write Thomas F. Wolfe, Cast Iron Pipe Research Ass'n, 1013 Peoples Gas Bldg., Chicago, Ill.

Couplings for Pipe

386. This sixteen-page booklet is a reprint of a magazine article by a consulting engineer. It describes in detail the installation of a 42" water line; contains specific information regarding pipe joints, field organization, laying pipe, tests, back-filling, etc. Sent free by S. R. Dresser Manufacturing Company, Bradford, Pa.

Feeders, Chlorine and Chemical

387. For chlorinating small water supplies, swimming pools and other installations. Flow of water controls dosage of chlorine (or other chemicals) providing required dosages, which are immediately adjustable. Driving is started and stopped automatically. Send for newest literature. %Proportioneers%, 9 Codding St., Providence, R. I.

Fire Hydrants

388. Two new bulletins on M-H fire hydrants and fully bronze mounted gate valves are now ready. Contain full specifications and instructions for ordering, installing, repairing, lengthening and using. Write M. & H. Valve & Fitting Co., Anniston, Ala.

Gate Valves

390. 28 page catalog contains illustrations and complete specifications of M-H standard and extra heavy iron body gate valves, horizontal swing check valves, flanged fittings and flanges, etc. Sent promptly on request by M. & H. Valve & Fittings Co., Anniston, Ala.

Manhole Covers and Inlets

403. Nuisance from loose, noisy manhole covers is eliminated by the use of Westeel rubber cushioned manhole covers and gratings. Six special advantages are explained in a new illustrated bulletin just issued by the West Steel Casting Co., 805 East 70th St., Cleveland, Ohio.

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter, crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

Pipe, Cast Iron

406. Data on cast iron pipe for water works systems, in sizes from 1¼ to 84 inches, including information on useful life, flow data, dimensions, etc., Thos. F. Wolfe, Cast Iron Pipe Research Ass'n, 1013 Peoples Gas Bldg., Chicago, Ill.

Pipe, 2-inch Cast Iron

407. The new McWane 2" cast iron pipe in 18-foot lengths has innumerable uses in water and sewage work. Send for the new McWane bulletin describing this pipe, the various joints used, and other details about it. McWane Cast Iron Pipe Co., Birmingham, Ala.

Pipe, Steel

408a. A very complete, 60 page, illustrated bulletin on spiral welded pipe including lots of useful engineering information, hydraulic data, flow charts, specifications, etc., issued by American Rolling Mill Co., Pipe Sales Div., 1101 Curtis St., Middletown, Ohio.

Pipe Forms

409. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

Pipe Joints

410. New folder describes in detail a new type of pipe joint—the Dresser Compression Coupling, Style 65, which is compact and self contained, makes a permanently tight joint under all conditions and is installed on plain end pipe in a few seconds with only one tool, a wrench. Get your copy today. S. R. Dresser Mfg. Co., Bradford, Pa.

Pipe Joint Compound

411. A new bulletin has recently been issued giving full details concerning Tegul Mineralead, a quick-sealing, trouble-free compound for bell and spigot joints which permits immediate closing of the trenches. Write The Atlas Mineral Products Co. of Pa., Mertztown, Pa.

412. New plastic sewer pipe joint compound, Servitite, contains chemicals which positively prevent root growth and gives watertight joint. Get complete information from Servicised Products Corp., 6046 West 65 St., Chicago, Ill.

Taste and Odor Control

413. How, when, and where activated carbon can and should be used to remove all kinds of tastes and odors from water supplies is told in a new booklet just issued by Industrial Chemical Sales Div., 230 Park Ave., New York, N. Y. 32 pages, table, illustrations and usable data.

Pumps and Well Water Systems

414. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps, fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for these three descriptive booklets. Layne & Bowler, Inc., Dept. W, General Office Memphis, Tenn.

Protective Pipe Coating

415. Coal-tar Pitch Enamels for exterior and interior linings for steel water lines; highly resistant to water absorption, soil acids and alkalis. Technical specifications for materials and their application will be sent on request. The Barrett Company, 40 Rector St., New York, N. Y.

Pumping Engines

417. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Run-off and Stream-Flow

420. Excellent booklet describes and illustrates the latest types of instruments for measuring run-off, both from small areas for storm sewer design, and from large areas for determining water shed yield. Sent promptly by Julien P. Friez & Sons, Baltimore, Md.

Screens, Sewage

421. The simple, automatic Laughlin self-cleaning, traveling screen is fully described in an interesting bulletin issued by Filtration Equipment Co., 10 East 40th St., New York, N. Y.

423. Be asurred of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straight-line Bar Screens" (Vertical and Inclined types). Link-Belt Co., 307 N. Michigan Avenue, Chicago, Ill.

Setting and Testing Equipment for Water Meters

424. All about setting and testing equipment for Water Meters—a beautifully printed and illustrated 40 page booklet giving full details concerning Ford setting and testing apparatus for all climates. Ford Meter Box Co., Wabash, Ind.

Screens

430. Water Screen Book No. 1252, describes traveling water intake screens and gives complete technical information about them. Link-Belt Co., 307 No. Michigan Ave., Chicago, Ill.

Sludge Incineration

438. A multiple hearth furnace which meets the most exacting municipal sanitary requirements for the incineration of sewage sludge—produces a fine ash or partially dry sludge for fertilizer—is described and illustrated with drawings and photographs in bulletins issued by Nichols Engineering and Research Corp., 40 Wall St., New York, N. Y. Operation as well as installation data is given.

440. Disposal of Municipal Refuse: Planning a disposal system; specifications. The production of refuse, weights, volume, characteristics. Fuel requirements for incineration. Suggestions for plant inspection, 45 pp., ill. Also detailed outline of factors involved in preparation of plans and specifications. Morse-Boulger Destructor Co., 202P East 44th St., N. Y.

Swimming Pool Equipment

444. Filters, chlorination, underwater lights and other supplies for swimming pools are very thoroughly described in literature and folders. Plans and layouts. Everson Filter Co., 625 W. Lake St., Chicago, Ill.

445. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Treatment

448. New 31-page catalog covers complete conveying, screening and reduction machinery for water purification and sewage treatment; describes and illustrates the design features of Jeffrey self-cleaning bar screen, combined screen and grinder, sewage screenings grinder, grit washer, conveyor type and positive discharge sludge collectors and green garbage grinder—includes installation views. Catalog 615, Jeffrey Manufacturing Co., Columbus, Ohio.

450. Standard Sewage Siphons for small disposal plants and PFT Rotary Distributors are new catalogs recently issued by Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill. The latter catalog contains typical plans and many illustrations of actual installations.

452. Eliminate sludge bed troubles, forget about weather conditions, odor nuisance, hail insurance and the like. Full details as to how Oliver United Vacuum Filters overcome these problems will be sent to all interested by Oliver United Filters, Inc., 33 West 42nd St., New York, N. Y.

453. How to avoid sludge and scum troubles in settling tanks explained in detail in Book No. 1542—has excellent drawings and photographs, also specifications. Most important are the carefully prepared capacity tables. Link-Belt Co., 307 N. Michigan Ave., Chicago, Illinois.

454. Full information regarding their newest equipment for sewage treatment and water purification will be sent on request by The Dorr Co., 570 Lexington Ave., New York, N. Y.

Thawing Equipment

460. Complete details concerning this quick-acting, efficient, electric pipe thawer which sells for only $39.25 complete, will be sent promptly by Commonwealth Mfg. Corp., Dept. P-710, 3785 Beachmont Ave., Cincinnati, Ohio.

Water Level Recorders, Portable

475. Everyone who has felt the need for a portable ground water level recorder will want this new folder which illustrates and tells all about the accurate, sensitive, Friez Model FW Portable Water Level Recorders. Ideal for ground water studies, hydraulic laboratories, etc. J. P. Friez & Sons, Baltimore & Central Aves., Baltimore, Md.

Water Works Operating Practices

490. This is a reprint of two excellent papers by F. E. Stuart. One outlines a number of filtration and field practices of value. The other presents a lot of kinks the author has picked up in visits to more than 1,000 water works plants. Sent free by Activated Alum Corp., Curtis Bay, Baltimore, Md.

For the Engineer's Library

Brief reviews of the latest books, booklets and catalogs for the public works engineer.

Mechanical Aeration for Sewage:

This is a new publication by Chicago Pump Co. Included is a basis of design for mechanical aerators giving: Oxygenation capacity characteristics, flexibility requirements in purification control and power consumption; and requirements for mixing, tank velocities, surface agitation and sub-zero operation. Three design tables are given: 1, tank volumes for various detention periods and rates of flow; 2, oxygenation capacity for all sizes of Chicago aerators; 3, aeration tank selection, including quantities of concrete for various types of tanks. Also, complete specifications and plans and designs for five representative plants. Sent on request to Chicago Pump Co., 2338 Wolfram St., Chicago, Ill. Ask for Bulletin 128-L.

Ferrisul for Water, Sewage, Etc.

An excellent 24-page booklet on the use of Ferrisul for coagulation of water, sewage, industrial wastes, etc. A lot of good information, with charts, etc. Directions for handling and feeding. Sent on request to Merrimac Chemical Co., Everett Station, Boston, Mass.

Elementary Soil Fundamentals:

This is a 60-page book with 13 illustrations and numerous charts. It was written by H. S. Gillette and published by the University of Oklahoma, Norman, Okla. It sells for 65 cents. We consider it a fine presentation of soil fundamentals and it will be valuable to every engineer.

Photos—What to Take and How:

Some time ago the Armco organization issued this booklet to educate Armco representatives in regard to photography. Here are directions on what to do and what not to do, samples of good pictures and of poor ones. Those interested in photography will find lots of value. Sent on request to W. H. Spindler, Armco Culvert Mfrs. Assn., Middletown, Ohio.

Borrowing for Highways:

By Edna Trull; published by Dun & Bradstreet, N. Y. 103 pp.; $2. A comprehensive discussion of highway financing and costs in the United States.

Industrial Packings:

A 112-page manual has been issued by United State Rubber Co., which includes a 12-page engineering section of specific gravities, steam temperatures, conversion charts, melting points, etc. There are 12 chapters, of which our readers may be most intersted in pump valves, gaskets, sheet packings, hydraulic packings and rod and plunger packings.

Sewage and Sludge Measurement:

Jeff Corydon has issued an excellent 24-page booklet that shows a plan of an activated sludge plant and discusses measurement, control and chemical treatment; venturi tubes for sewage and sludge; selection of metering instruments; the "long-distance" chronoflow meter; and finally presents an album of installations. Many blue-prints and illustrations. Sent on request. Proportioneers, 9 Codding St., Providence, R. I.

Lighting for Outdoor Events:

A series of lighting plans for outdoor swimming pools, tennis courts, softball and football fields, etc., have been prepared by Goodrich Electric Co., 2900 North Oakley Ave., Chicago, Ill., and will be sent on request, without obligation.

Salt-Stabilized Roads:

Morton Salt Co., Hutchinson, Kans., has issued a new "recommended specifications" for salt stabilized roads. This (and also the other two texts in the series, "Construction Manual" and "Base Courses") will be sent on request to Brant Holme, Chief Engineer, at the above address.

Sheet Piling:

A booklet on steel sheet piling has been issued by Inland Steel Co., which gives considerable technical information on sections, sizes, uses, etc. 12 pp.; sent on request. Ask for Catalog 3. Inland Steel Co., Chicago, Ill.

Fluid Meters:

A new 40-page catalog, "Bailey Fluid Meters for Steam, Liquids and Gases," Bulletin 301; Bailey Meter Company, Cleveland, Ohio. This bulletin illustrates the manner in which any desired combination of indicating, recording and integrating features may be combined with a flow mechanism suitable for the measurement of steam, liquids or gases under high, low or medium pressures.

It explains the Ledoux Bell flow mechanism, and how auxiliary recorders for pressure and temperature may be incorporated to record on the same chart with the record of flow; also describes the Bailey Escapement Integrator.

LeTourneau History:

This little booklet sketches in a most interesting fashion the development of earthmoving through the LeTourneau organization. Within it are pictures of most of the LeTourneau folks. Sent on request to R. G. LeTourneau, Peoria, Ill.

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